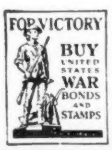
AGRICULTURAL ENGINEERING

JULY 1943

"United We Stand"



THE JOURNAL OF THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

Protect Her Precious Protein

You can't buy any better protein at any price than the protein which Nature puts into fresh green grasses and legumes. Nobody can improve on Nature. No method or machine can *add* anything. All that modern equipment and management can do is to *preserve* in winter forage the goodness that grew in summer.

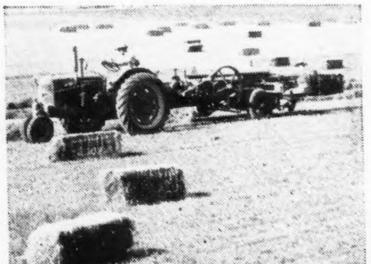
Protein in hay is highly perishable. Every drop of rain or dew damages or diminishes it. Every leaf knocked off is a three-fold loss because three-quarters of the protein in alfalfa, for example, are in the leaves, one quarter in the stems.

Other vital feeding factors are just as perishable. Every hour that leaves are exposed to sunlight robs them of color, of vitamins, of aroma and palatability. Minerals are lost by exposure to moisture. So are other nutrients.

From mowing of the crop to manger or feed rack, the Case System of making Air-Conditioned Hay resists these robbers, holds losses to the lowest practical limit, preserves the utmost of the precious elements. From start to finish it keeps more leaves in the hay, more vital goodness in the leaves. Key machine in the first half of this System is the Case Side Delivery Rake that guards against losses until the crop is air-cured in the windrow.

Second half of the System is performed with the Case Sliced-Hay Pick-Up Baler. Without pitching or pulling, it lifts the hay gently from the windrow. Once compressed in the bale, there is no chance for leaves to be lost in hauling, storing, or handling. Because the bales need no pulling apart but divide into portions like sliced bread, they guard against leaf losses at feeding time.

Summer-sealed for winter feeding, hay made by the complete Case System enables you to carry more cows on your meadow acreage. It enables you to push the production per cow with less of purchased protein. It does all this not with more, but with less total labor per ton.



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You may not be able to get a Case Sliced-Hay baler now, because few are being built due to war-time limitations. But you can plan now to be one of the first purchasers when this baler again may be freely built. Meanwhile, put into practice as much as you can of the Case System, using the equipment you have. Ask your Case dealer or write us for book showing every step and short-cut in this time-saving, leaf-saving way to make hay. J. I. Case Co., Racine, Wis., or nearest branch.

CASE

THE BONDS YOU BUY NOW WILL BUY A BALER LATER

As a service to agriculture, this message is appearing in farm papers. It is one of a series urging farmers to adopt advanced practices, using equipment they already have to promote war-time food production and conserve agricultural resources, J. I. Case Co., Racine, Wis.

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AGRICULTURAL ENGINEERING

Established 1920

This Journal is owned, edited, and published monthly by the American Society of Agricultural Engineers.

Editorial and advertising departments at the executive office of the Society, Saint Joseph, Michigan. Publication office at Benton Harbor, Michigan.

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SUBSCRIPTION PRICE: To non-members of the A.S.A.E., $3.00 a year in the U. S. and possessions and in Americo-Spanish countries, $3.50 a year in Canada, and $4.00 a year in all other countries; to A.S.A.E. members anywhere, $2.00 a year. Single copies (current), 30 cents each.

POST OFFICE ENTRY: Entered as second-class matter, October 28, 1933, at the post office at Benton Harbor, Michigan, under the Act of August 24, 1912. Additional entry at St. Joseph, Michigan. Acceptance for mailing at the special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized August 11, 1921.

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Vol. 24, No. 7

EDITORIAL

Put in the Professionals

IN THE laudable effort to learn from the war experience of our British brethren there is one point wherein we seem to follow them in reverse. Their choice is the amateur in athletics and the professional in administration; ours too often is the professional in athletics and the amateur in administration.

Time after time, during the first eighteen months of the war, we have seen the man of proved genius, in industry and agriculture, shut out or shelved, or shorn of his power and reduced to the status of a false front while actual authority was exercised by others whose qualifications consisted of political acceptability or exalted philosophy. No wonder that it has become almost a rule that good men resign and the mediocrer remain. No wonder that our food program already has cost several times as much, in its manifold ramifications, as did the comparable program in all of World War I and still is wandering in the wilderness.

An example is the appearance of potatoes hip-deep on a Chicago dump while housewives search the stores for spuds and full-page propaganda advertisements are built on their scarcity. Newspapers report cars of potatoes arriving from the South with spoilage ranging up to 75 per cent because adequate icing enroute is verboten by some bureaucratic edict. As if men who have devoted their lives to growing, shipping, and distributing potatoes cannot be trusted to judge how much ice it takes to get them to destination in edible condition!

In bright but belated contrast is the change evident at the panel discussion, during the annual meeting of the American Society of Agricultural Engineers last month, in the administration of the farm machinery program. Gone were the fantastic formulas whereby machinery manufacture was limited to a pitiful fraction of needs and the remnant relegated to minor manufacturers unable to match the requirements either of production or distribution. Instead was a strong spirit of resolve to secure for the industry what it needs to supply the food program most efficiently.

Not mere emissaries bearing bad news, as in yesteryear, but men of understanding and apparent authority represented the government on this panel. That the majority of them happened to be members of the A.S.A.E. is significant; not that membership creates good judgment, but that men of adequate training and experience for such responsibility are also qualified for membership. In a word they are professionals.

A lesson learned at such cost to the country should not be limited to the manufacture of farm machinery, but lifted aloft as a beacon to guide all the policies of government in the battle of production. Let us discard the quaint notion that unfamiliarity or failure in business is the foremost qualification for supervising business on behalf of government. Let us practice instead the principle that outstanding success in prior experience within any field is the only sure proof of competency to assume authority therein.

Power and Potatoes

RELEVANT to the work of the War Activities Committee of the American Society of Agricultural Engineers and of our members concerned with rental and custom usage of farm machines are some data reported by A.S.A.E. member, John F. Benham, agricultural agent of the Pennsylvania Railroad. Speaking of intensive potato production in Potter County, Pennsylvania, he cited a representation to the WPB by the people of this county that they could produce a million more bushels if they were permitted to get thirteen rubber-tired tractors with equipment for spraying.

From a letter by the county agent, Bert Straw, Mr. Benham quotes that this is in furtherance of "the spray group idea which we have been developing for some time. We have expanded now to 21 spray groups. We have 35 outfits doing custom plowing and fitting, and 14 doing custom potato planting on an organized basis."

The county agent continues with an estimate that in the one county the group usage of machinery is saving more than 500 farm laborers. As he puts it, " the custom operator is doing the seasonal job and permitting the farm owner to proceed with his regular work on the farm. We are increasing our acreage of potatoes this year by 50 per cent.

"There is no question in my mind that with proper organization, a little cooperation, and not too much external interference, this group system can save the small farmer an immense amount on his cost of operation. I believe we can reduce his investment in equipment by 90 per cent, and give him a more efficient job."

Aside from the figures, which would be impressive even with considerable discount, two of his passing points seem to us significant. One is the implication that the groups, however organized, are served by custom operators. The other is his caution about external interference.

Tax Excess Profits of Persons

MONTH by month, as we have observed the steady trend toward inflation, and the feeble gestures toward its restraint, we are more and more convinced that the privilege of paying excess profits taxes should not be limited to corporations but should be extended to natural persons. Already it is embodied in certain "windfall" provisions. We propose that it be adopted frankly and fully.

High incomes are not of themselves inflationary; it is the rapid increase of incomes, large or small, that puts pressure on the supply of civilian goods and creates the perils of the so-called inflationary gap. However repugnant it may be to the social-gainers, it is a realistic fact that most of the unsatiated and insatiable appetite for consumer goods arises now from the low and moderate income brackets. It is inconceivable, for example, that the amazing if not alarming gallonage of high-priced liquor is being consumed by persons who, despite the demagogues, continue to receive incomes above $25,000 a year.

Simply as citizens, with something more than average influence in proportion to number, and with considerably more than average intelligence to guide their influence, agricultural engineers are honor-bound to use their influence in any and all ways to resist inflation. They are not gagged by political considerations. They have the sense to see that every dollar of inflation that finds its way into the national debt is a burden on posterity, that every lift of the price level is a fraud on the purchaser of war bonds.

The latter point is of particular concern to our profession. All our plans for improving the estate of agriculture, postponed for the duration, depend on farm purchasing power. New and better buildings, more and better machinery, farmstead electrification, and erosion control structures — all can come only in propor- *(Continued on page 247)*

Production Engineering on the Land

By H. B. Walker
FELLOW A.S.A.E.

HARRY BRUCE WALKER
President, A.S.A.E., 1942-43

AT NO time in the history of our nation has the future of the country depended so much upon engineers. True enough the materials with which engineers work are the cause of our greatest public concern and attention, but, basically, it is the science and art of engineering which have so altered the environment of mankind as to cause these materials to become "critical" when nations resort to force of arms for survival.

It is unfortunate for all of mankind that the forces and materials of nature should be utilized so wastefully in the brutal business of war when it is so evident that with the same or less effort their application to more peaceful pursuits offers such vast potentialities for human welfare. The consuming flame of war, however, is kindled in the hearts of men by avarice and hate. Engineers, up to the present at least, unfortunately have become as much the tools of unscrupulous war lords as they are the indispensable personnel of nations which are called upon to defend their existence against selfish aggression. The potentialities of the engineering profession devoted to peaceful pursuits far surpass its usefulness in a war of survival, but such matters are at the moment secondary since the immediate task is to defeat the aggressors. It is to be hoped, however, that when men return to more rationalized living, the engineer will be afforded the same opportunities for service in peace that have been accorded to him so freely in war.

The developments of the past year have brought the crises of food production in war to the forefront. At last idealisms are giving way to realisms; promises are being made with more caution; and the cries of the near hungry are commanding attention on a closer parity basis with those who thought of war primarily, in terms of ships, planes, guns, and other war ordnance. The past year has developed the sobering conviction that the 1942 errors in agricultural policy will be reflected in the food production of 1943, and this in turn will be further reflected in available consumer food supplies in the critical war months ahead. This is no time to rehearse errors in planning. These errors have been admitted by the highest in government. Our chief concern now is to avoid a repetition of these mistakes in order that we may have "food to win the war", and, some left over as an aid in writing the peace.

The successes attained by our gallant military organizations only increase the demands upon our country for food. No matter how guarded our statements now may become, the fact remains that the oppressed peoples of Europe and Asia, as well as our allies, look to us for hunger satisfaction, and in this we can hardly afford to disappoint them if we are to realize the full benefits of final victory. No longer can we afford to speculate with idealistic approaches, such as have dominated many of our past attempts to solve the vital food problems.

It is comforting to us as agricultural engineers, and I believe a favorable omen for the future of our food production, to note that finally government agencies are beginning to recognize that agriculture, as an industry, is a consumer of goods as well as a producer of products. These two are so interrelated that any policy which stifles either the flow of goods and supplies to the farms or the flow of products from the land affects the other, as has been so well demonstrated in recent months. War calls for the optimum flow of products from the land; thus the goods utilized in an efficient mechanized agriculture must flow to the land. The one-way road system cannot long be maintained without seriously interrupting our agricultural system.

The admission on the part of the government that farmers will not have the equipment they should have to attain 1943 production goals should not be taken as the green light for a complete fulfillment of farm equipment requirements in 1944. It simply implies an attempt at improvement. Moreover, manufacture of needed equipment and supplies, important and essential as it is, is only one part of the problem. Agriculture is also affected with the final distribution of goods and services. The distribution methods of 1943 should not be repeated and, fortunately, the indications are they will not be. Neither should economic and other controls on production be permitted to become so strong and inflexible as to rob farmers of the exercise of sound judgment and initiative. It is apparent from the many regulations now in effect, which have without doubt been formulated in a sincere effort to produce urgently needed war crops, that with the many limitations on labor, equipment, fuels, transportation, containers, fertilizers, credit, etc., pressures can readily be exerted on the farmer which may deprive him of his initiative in adjusting his operations to meet the ever-changing conditions imposed by nature. If we take away from farmers the exercise of common sense and judgment which years of experience have developed, in their personal contact with their farms, in meeting the vagaries of weather, pests and variable soils, and interfere with their experience in handling and managing labor, we will then have made inoperative some of the most valuable productive assets of American farming.

The regimenting of farm operations, the doling out of equipment, fuels, fertilizers, etc., afford excellent paper planning potentialities for economic theorists with unsoiled hands — planning which might work too if it were not necessary to take into account the people who have the crops to produce. Our agriculture has been founded on the principles of private enterprise and individual initiative. Its past record of achievement provides ample evidence of its productive potentialities under the guiding influence of sound technological development. Farmers, however, and to a lesser degree those who consume or utilize their products, become more or less servile to government when dependency for production lies more and more in crop subsidies and incentive payments with the products of the land subsequently distributed through the guidance of government agencies for resale to consumers at a federal monetary loss. It is difficult for responsible citizenship to rationalize such procedure which calls for an ever-expanding manpower program in government overhead, and a corresponding diminishing supply of productive manpower which must use more and more of its time in reading and following directives prepared by overlapping federal agencies.

It must be frankly admitted that we as citizens in our respective areas of activity have little opportunity to get a broad viewpoint of the international food problem. That is the penalty a global war imposes, particularly when food has become belatedly a recognized weapon of warfare, and then all at once so important that food conferences must take on an air of military secrecy. On the other hand, many farmers as well as others of us close to the sources of food production observe with uneasiness the growing tendency of government to control and manipulate details in production which might better be left to a loyal and more experienced rural population, which possesses the common sense and good judgment required for practical farm management. Moreover, over-

Address of the President of the American Society of Agricultural Engineers before the 36th annual meeting of the Society at Lafayette, Ind., June 1943.

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lapping of government agencies, petty jealousies in administrative controls, incompetency and red tape when brought so close to farm operations, take away from our farmers the feeling of responsibility and partnership in the war effort, which is so essential to ultimate success.

Our farm citizenship, as well as those who serve the farming industry, is capable of accepting more trust and responsibility than federal bureaucracy now permits. When this asset of farm citizenship is more fully utilized, federal agencies will have more time to rationalize the broader aspects of the food problem which were implied in the "Freedom from Want" phrase in the Atlantic Charter.

Our Society and its membership occupy a rather enviable place in service to agriculture, both in war and in peace. We must admit, however, that it also implies responsibilities of vast proportions. From the beginning of our organization thirty-six years ago, one of the cardinal principles motivating our activities has been efficient agricultural production. At times this principle has been challenged by those who feared farmers were becoming too efficient and the government set up regulations and various types of economic controls to slow down food and fiber production. The experiences in this war, however, have amply demonstrated the manpower advantages of nations which have efficiency in agricultural production. Even under the handicaps imposed by the carry-over of the ideas of suppressed production, our nation, because of its liberal use of labor-saving equipment and the application of the best technological methods in growing crops, has been able to produce large volumes of needed farm products with limited labor.

The mechanization of agriculture has contributed more than just a little to making our nation "the arsenal of the democracies", and our Society activities covering more than a third of a century of technical service to this vital industry has fostered those programs in farm production which add more than just a little to our national stature in this war for survival.

While the agricultural policies of our nation during a decade or more, based as they were on a program of scarcity, have contributed to some loss in potential productive capacity and to a greater dependency upon food imports, this fact is evident that at the moment we have no real need for added farm land area. The problem today is to provide the facilities to get the most from the land already available. This is basically a simple problem, even though it may be difficult of attainment in wartime. It requires labor, equipment, water, fertilizers, and supplies of various types to produce the crops which may be produced readily on the land we now have. Likewise, when crops are brought to maturity and harvest there must also be processing plants, storage facilities, and suitable transportation to bring the surplus products of our fields to a rapidly increasing dependent military and urban population. No nation, heretofore, has engaged itself in such a gigantic enterprise of war with its attendant food problems as our own. The nature of the task is such that our horizons of effort are limitless. We can easily expand our tasks into exhaustion, or we may more wisely rationalize our capacities and integrate these into an efficient coordination of productive effort.

For agriculture this involves not only efficiency in the use of men and equipment but also a program of crop selection which will yield the maximum of food energy from such manpower and equipment as may be available. Some evidence of this sort of planning appears in the 1943 program, as, for example, the rather belated drive to grow more dry beans and peas. Such programs, however, must be cautiously and wisely planned, if we are to maintain a safe equilibrium in our farm economy. Farms, after all, are production types and each unit has an organization peculiar to its own operating conditions. While corn, for example, may provide more net energy when consumed directly by humans, it does not follow that our war economy would be served best by eliminating livestock in order to switch from long-chain energy production to short-chain energy production. But as the war continues and our human and material resources more nearly approach the inevitable exhaustion, such changes must occur.

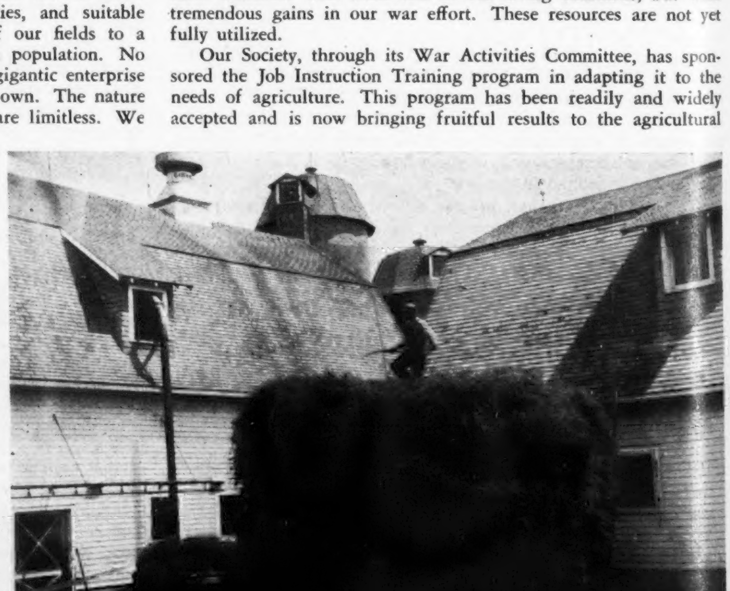
As engineers serving agriculture we must be prepared to recognize these trends and their probable consequences if we are to render maximum service to the industry. If some types of livestock and certain low energy crops should receive less production emphasis and other crops like potatoes, beans, peanuts, flax, and the cereals more, the harvesting, processing, storage, and transportation of these must be carried out to avoid bottlenecks in production which might readily occur unless adequate technical foresight is provided. Any changes of this nature must of necessity be gradual and geographically well distributed if grave disturbances to our established systems of farm economy are to be avoided.

While agricultural engineers are not in a position to determine the world food needs during a global war, once the food requirements are defined and the patterns of production outlined, they should be able to utilize efficiently the available resources of power, equipment, and labor to obtain the maximum productive return. As one of our prominent members (George Kreiger) has so well stated, "Farm equipment constitutes the machine tools of agriculture". A factory without tools has no output, while an efficient factory has its production equipment geared to its desired output. We, as agricultural engineers, are in a position to gear the equipment needs to production in our respective areas when we know the kinds and volumes of crops needed for the war effort. Members of our Society are now rendering such service in the field and in government offices.

Naturally, our operations are circumscribed by men and materials. The various federal claimant agencies filing on the material and labor stock piles of our nation may readily and very easily demand more than is available, in which case programs must be pared down to fit these controlling factors and still yield a balanced "all-out" national effort. It is apparent from the experiences of the past year that agriculture has passed the peak of its productive effort unless corrective measures are taken to supply both needed manpower and equipment.

Based upon our social and labor standards of two years ago, we are now doing what was then considered impossible. We ourselves, as well as our enemies, were unable to comprehend the vastness of the latent labor resources in a nation, practicing with near religious fervor the short work week, upholding strict child labor laws, observing the traditions of protecting its womanhood from arduous labor, and which provides liberal old-age pension systems. War necessity has forced us to draw upon these latent labor resources with some loss in our living standards, but with tremendous gains in our war effort. These resources are not yet fully utilized.

Our Society, through its War Activities Committee, has sponsored the Job Instruction Training program in adapting it to the needs of agriculture. This program has been readily and widely accepted and is now bringing fruitful results to the agricultural



industry. We as engineers, however, who are concerned with power and equipment utilized in crop production and processing, must not lose sight of the fact that high efficiency in any type of production utilizing machines is attained only with high-grade management and skilled operators. The time has passed when agriculture can get along with "left-over" labor. More key men possessing skill with equipment and knowing farming techniques are needed on our farms if better manpower and machine efficiencies are to be attained. Our whole civilian educational system for training skilled and competent workers for agriculture has deteriorated under the impact of war, and until some corrections are possible manpower efficiencies in crop production must suffer.

There are some rather outstanding opportunities for betterment of farm production efficiencies through the use of equipment, which up to now have been throttled by material distribution formulas which tend to suppress technological developments. New types of labor-saving equipment, such as field harvesters, crop loading and unloading devices, storage and processing equipment, etc., should be more readily available through normal industrial channels. If such were available, man-hours of labor input could be materially lowered, and it would make possible the better utilization of the lighter types of labor now available in greater abundance than in past years.

It is to hoped that our federal claimant agencies which levy on the nation's stockpiles of critical materials will recognize these opportunities for saving our manpower and which at the same time improve the output of our land and labor. I have faith in the sincerity of purpose of those who have the responsibility of making final decisions in these matters. When there are so many agencies involved, however, which have authority to file upon the nation's manpower and material resources for military, lend-lease, and other purposes, and when these overlap in their demands upon the nation's food supplies, both actual and potential, those of us charged with the problems of domestic production may very well wonder at times if agriculture at home is receiving the consideration it deserves.

IN SPITE OF HANDICAPS, AGRICULTURAL ENGINEERS ARE RENDERING WORTH-WHILE SERVICE IN THE WAR EMERGENCY

In spite of the handicaps which may be imposed on agricultural production, we as agricultural engineers enjoy the satisfaction of rendering worth-while service to our nation in this emergency period. For this reason our Society now has the responsibility of maintaining close unity of effort in all of its fields of activity. Likewise, there must be close cooperation between state and federal service agencies, and those who carry out the more tangible productive effort in fields and factories.

I am sure all of our Society members are concerned with the recent administrative reorganization of agricultural engineering in the U. S. Department of Agriculture. As a Society we are not concerned directly with matters of administration as such, but we do have an interest in reorganization as it relates to the engineering services agriculture requires in matters relating to farm structures, power and machinery, rural electrification, soil and water conservation, and the related research activities in connection therewith. We should be sympathetic with any changes which offer improved services to agriculture, but we should be sternly critical of any reorganization which omits essential engineering services to the nation's farms. I am sure I speak for our members when I pledge our cooperation in any constructive program which adequately supports engineering service to agriculture.

The essentiality of engineering service to agriculture will in no way be lessened by the coming of the peace. In fact the reconstruction period with the world-wide demand for products of the land, make it necessary for us to think constructively and with much foresight of the postwar period. The present war program has utilized the output of higher education more than in any previous conflict. Likewise, because of the need of haste in military organization, it is doing much to disintegrate these same educational systems which have been the source of so much of our military leadership. This impact is keenly felt in agriculture because war industry programs have neglected to provide training and facilities for this essential field. We will, therefore, be faced with inadequately trained personnel to meet the postwar agricultural problems.

In our field very few engineers are now being specifically prepared for agricultural engineering. Many of our younger engineers have been absorbed for military duties and some of these will not return to their former fields of work. On the other hand, engineers from related fields will no doubt be available and more plentiful, and we should be prepared to cooperate with these in giving service to agriculture. In this our Society meetings afford a common forum where engineers from other fields may come to discuss and discover the problems of the land.

No matter what the outcome of this war may be, we can hardly expect to return to our prewar practices. Basically, engineering will not be much changed, but the external influences on the practice of engineering in our own and other fields will be changed. International relations, social standards, communications systems, new materials, new experiences in the use of these, war depletion of old materials, public debt pressures, heavy overhead in government, these and many other factors will form the changed environments influencing engineering analysis. We are certain to emerge from the war period with a depletion of technically trained agricultural engineers. Those which may be available will have much to relearn if they are to become the real leaders in reconstruction. It is to be hoped technical societies, and more particularly our own, will not become lax in fostering literature relating to technical progress. While this may seem more or less useless at the moment, the lack of it for the future may become a serious handicap in peacetime programs. Our younger membership, already depleted by war influences, will carry a particularly heavy responsibility for our future progress.

NO TECHNICAL PROFESSION SO CLOSELY RELATED TO THE PEOPLE IT SERVES AS THE AGRICULTURAL ENGINEERS

As engineers serving agriculture, we have every reason to feel confident that if given the opportunity to utilize the forces and materials of nature for the benefit of mankind, there should be actual freedom from want for the essentials of healthy living for all worthy people of our nation. Likewise, if given the opportunity engineers can assist other technologists in pointing the way toward this goal for all of the peoples of the world. No other technical profession is so closely related to the people it serves as agricultural engineers. Not only do they supply agriculture with those things needed for efficient production, processing, storage, and transportation of the products of the land but they are also concerned with those things which contribute to the welfare and comfort of those who live on the land.

This brings us in close contact with the problems of rural folks. Their way of life is our concern and as engineers we should give some thought to the future pattern for agriculture. It would seem from past experience that the foundation of our food and fiber supply rests upon an intelligent farm people properly equipped with modern power and field equipment used for the most part on independently operated farms where the farmer and his family and his workers may live in comfort with modern conveniences which engineering functioning through the industrial plants of the nation can supply.

Agriculture is the only industry which through sound scientific and technological practices may restore to the land on which it operates the substances removed through cropping cycles. With the depletion of the stored mineral resources of the world this industry will be called upon to supply more and more organic substances for use by industry to take the place of our irreplaceable mineral resources. Thus the soil is a basic resource which need not be permanently expended if properly husbanded. Engineers have a direct responsibility in the conservation of our soils.

We as agricultural engineers have just reason to feel proud of our service to mankind. It calls for intelligent consistent effort backed by what some have characterized as a missionary zeal. We have in our Society the nation's leadership in this great field of service to agriculture; thus we have in our organization the elements of strength for professional growth. I know each of us prizes his Society membership, but the greatness of the tasks ahead call for more personnel than we now have. We should seek recruitment of capable talent.

We have passed through a critical year with strength and increased resources. Let us accept without reservation the opportunities for service in war and in peace which are in the days ahead and strive with all our might to foster agricultural efficiency through production engineering on the land.

Machinery Problems of Mulch Culture

By C. K. Shedd and R. A. Norton
FELLOW A.S.A.E. MEMBER A.S.A.E.

STUDIES of mulch culture were conducted in 1942 at Ames, Iowa, for the purpose of establishing some of the principles of design and operation of farm machines in their relation to this practice as a soil conservation measure. These studies were carried on cooperatively by the Bureau of Agricultural Chemistry and Engineering and the Soil Conservation Service of the U. S. Department of Agriculture and the Iowa Agricultural Experiment Station. Somewhat less extensive studies had also been in progress in the years 1940 and 1941.

Three experimental fields, each carrying a 3-year rotation of corn, corn, oats-sweet clover catch crop, were established in 1942. Seven treatments, as follows, are compared in a plot experiment with six replications on each of these fields.

(a) Normal amount of residue on surface; seedbed preparation by subsurface cultivator

(b) Twice the normal amount of residue on surface; seed-bed preparation by subsurface cultivator

(c) Three times the normal amount of residue on surface; seedbed preparation by subsurface cultivator. (Treatment of (c) plots was changed in 1943 to twice the normal amount of residue plus application of commercial nitrogen fertilizer)

(d) Residue removed; seedbed preparation by subsurface cultivator

(e) Residue removed; seedbed preparation by plow, tandem-disk harrow and spike-tooth harrow

(f) Residue removed; plowed; residue returned to surface; final seedbed preparation by subsurface cultivator

(g) Residue plowed under; final seedbed preparation by tandem-disk harrow and spike-tooth harrow (conventional practice).

Treatments are planned to be continued for several years on the same plots to observe long-time, as well as immediate effects.

In each of these fields approximately three replications are on rolling soils of the Clarion series and three on relatively flat soils of the Webster series. These soils are almost always closely associated, and, therefore, if a new cultural practice is to be recommended for one of them, it should first be proved reasonably effective for the other.

The subsurface cultivator used for seedbed preparation in these experiments is illustrated in Fig. 1. Plots were tilled twice with this machine, the first tillage in April and the second just before planting in May. A stalk cutter was pulled ahead of the cultivator at the first tillage only. In 1942 both tillages were to a depth of 5 in, but in 1943 the first tillage was to a depth of 3 in and the second to a depth of 5 in. It is considered that better soil tilth was obtained by the practice followed in 1943.

Paper presented at the annual meeting of the American Society of Agricultural Engineers at Purdue University, June, 1943. A contribution of the Power and Machinery and Soil and Water Conservation Divisions.

C. K. SHEDD is agricultural engineer (BPISAE), and R. A. NORTON is soil conservationist (research) (SCS), both of the U. S. Department of Agriculture.

No important difficulties were encountered in planting with a standard type planter equipped with a disk furrowing attachment. First cultivation was performed with a cultivator equipped as illustrated in Figs. 2 and 3. For later cultivation the disk hillers were changed to throw soil toward the corn row. This equipment was effective in weed control and operated without clogging difficulties; however, it mixed the crop residue with the top soil to an undesirable extent.

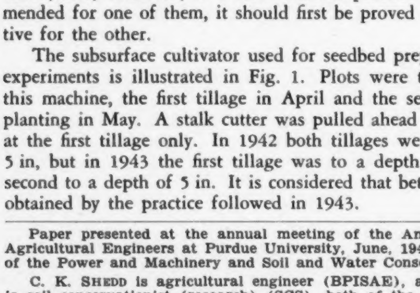
Data for the year 1942 are presented in Table 1. These data, together with field observations, lead to the following conclusions: Where subsurface tillage by means of sweeps was used on the Clarion soil, corn yields were almost identical with those obtained where the residues were plowed under. On the Webster soil, yields secured through this practice were reduced about 38 per cent below those obtained by the conventional method.

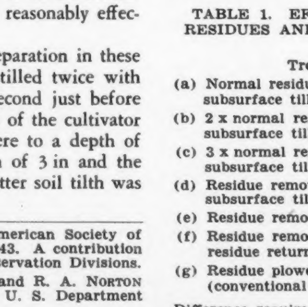
When the procedure described under treatment (f) above was followed, the yields were somewhat higher than those observed under the conventional plowing and surface planting. Seedbed preparation for the plots receiving treatment (f) was much too complicated for practical farm use; but it is possible that by modifying the method of use of existing machines or by slight modifications in their design a similar seedbed may be prepared. The requirements are: (1) The surface soil must be sufficiently broken up to permit satisfactory aeration; (2) the residue must be kept on the surface and not mixed with the disturbed layer to any appreciable extent; and (3) it may be necessary to invert the surface layer of soil but the necessity for this has not been established.

The amount of residue on the surface seemed to be unimportant as shown by results from plots (a), (b), (c), and (d), but perhaps some differences will appear here if the residue tends to accumulate on the soil surface over a period of years. An exception appears in plot (d) on the soils of the Webster series, where a somewhat higher yield accompanied complete removal of residues. Apparently this was due to elimination of the undesirable factor of mixture of residues with the upper layer of soil. The further increase in yields shown by plowing *(Continued on page 230)*

TABLE 1. EFFECT OF AMOUNT AND POSITION OF CROP RESIDUES AND OF CULTURAL METHODS ON CORN YIELDS

Treatment	Corn, bu/acre (15% moisture) On Clarion Soils	On Webster Soils
(a) Normal residue; subsurface tilled	50.6	34.5
(b) 2 x normal residue; subsurface tilled	50.8	34.4
(c) 3 x normal residue; subsurface tilled	46.5	34.9
(d) Residue removed; subsurface tilled	49.6	48.9
(e) Residue removed; plowed	52.5	54.4
(f) Residue removed; plowed; residue returned to surface	54.7	56.4
(g) Residue plowed under (conventional practice)	49.6	55.6
Difference required for significance	8.5	10.5





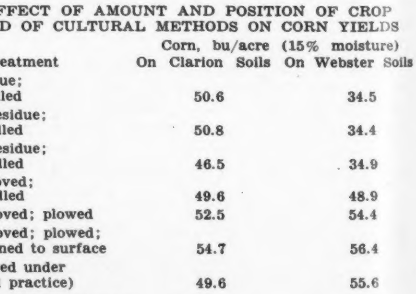


Fig. 1 (Left) Subsurface cultivator used for seedbed preparation for corn. The stalk cutter was pulled ahead of the cultivator only at the first tillage • Fig. 2 (Center) Front view of cultivator equipment used for interrow tillage of corn under mulch culture • Fig. 3 (Right) Side view of the tractor-mounted cultivator equipment, shown in Fig. 2, used in the Iowa studies described in this paper

The Agricultural Engineer's World

By Wheeler McMillen
ASSOCIATE MEMBER A.S.A.E.

THE WORLD is growing hungry in this year of global bloodshed and destruction. Before the sun shall shine again upon an era of peace, the world will grow hungrier. Stark starvation is already the prospect for millions of children and of adults.

For most of the areas of the earth this will not be the first time that the threat of famine has alarmed cities and countryside. Starvation has been recurrent through all the generations of man.

Indeed, never yet in recorded time has there been a single day when every healthy individual on earth has been able to obtain three square meals. Perhaps it is true to say that in America are the only people who have never in their history experienced a famine. Our record is a little less than perfect, for not all Americans have been shown how to earn their share of our plenty.

In full view on the one hand is the luxuriant willingness of nature. On the other is the staring fact that the human race has never been far ahead in the contest against starvation, and time after time has fallen behind. Is there something fundamentally wrong with the species of man when, after uncountable centuries, he has not found how to keep himself provided with so basic an essential as food? The more one looks at this fact the more astounding it becomes.

More than two billion human beings walk the earth today. Most of them walk in poverty. Scant of food, they live in need of better clothing, of decent sanitation and health, of suitable homes, of proper education, to say nothing of living without facilities for recreation and ease.

As a basis for discussion one might assume that there were, before this war, 100,000,000 people in the world who enjoyed a scale of living comparable to that of the most favored third of Americans. One might further assume that such a scale represented a fairly ideal abundance of human satisfaction, so far as present knowledge permits. A very rough conclusion could then be drawn that the ability of the human race to produce goods would have to be multiplied twenty-fold to permit a universal consumption comparable to that which many of us regard as still somewhat less than wholly satisfactory.

Whether the expansion should be twenty-fold or ten-fold, the probability is that most of humanity would cheerfully settle for ten per cent, and would consider that a millenium had arrived if enabled to earn and consume an additional twenty per cent of food and other goods. To live twenty per cent better certainly would be to live in abundance for a large majority of the present generation of people; it would be beyond any hopes they have ever cherished.

The foremost interest of every family in the world is food, closely followed by the other essentials of living, such as clothing and shelter. No family in chronic want of these basic necessities can be much interested in other matters. The hungry man with a hungry family is not likely to turn his mind to problems of world federation. He is not likely to be particular about the kind of government in his own country, so long as it will promise him food.

After all the generations of his time, the common man has not solved his food problem, although it is the first of his responsibilities. Neither has it been solved for him by his leaders and rulers. Ever since the tribes began to organize, chiefs and kings, prime ministers and presidents have assumed certain responsibilities for their followers. They have assumed to say by what rules men shall live and when they shall risk their lives in war, but they have not provided that he shall always eat. The statesmen have not solved the food problem. As recently as a month ago they were holding a forty-four-nation conference about it at Hot Springs. The cheerful announcements handed out from there did not claim to have solved it. Perhaps the fact that they discovered the existence of such a problem was, for statesmen, an advance.

Today the world's poverty in food, and in all good things, is mounting, because the world is engaged in war. The energies of millions of men are engaged in killing and in preparing the means of killing. The worldwide failure of statesmen has resulted in worldwide destruction and impoverishment.

It is not my desire to be too severe upon the statesman for his failure to solve the problem of satisfying man's wants. His principal fault has been his tendency to get in the way of those who can produce; that, and his tendency to demand for his particular purposes too large a portion of his country's production. His medium is government, which man must have and which, as Benjamin Franklin is credited with saying, is a good thing but, like fire, must be watched.

Through the organization of government a few aids to production can be channelled. Government can finance research which would not otherwise be accomplished. It can conduct education which is an all too much neglected function both of government and of private enterprise. It can operate those proper regulations which prevent the unfair individual from taking advantage of the reasonable or the weak.

There is one great contribution which *people must require* that their government make to production.

That contribution is liberty.

I do not mean the kind of freedom that is quartered and labelled. I do not mean freedom either multiplied by four or divided by four. I mean the broad personal independence which leaves man free to work, to live, to decide his destiny within his capacity; the kind which offers him the incentive of reward and the choice of his way of life; the kind which does not bargain with him at the rate of so much freedom for so much government check.

I do mean the simple, undiluted, unfractionated liberty which leaves off only where the just rights of others begin.

Once the prerequisite of full liberty is established, from out the mass of man there will gradually emerge those who can solve the problems of production. Here in this continent, under freedom, inspired by the natural motives of a free economy, the vision of a genuine abundance has been glimpsed by man for the first time in human history — a vision that will be an assured and an ever-

An address before the 36th annual meeting of the American Society of Agricultural Engineers at Lafayette, Ind., June 1943.

WHEELER McMILLEN is editor-in-chief, Farm Journal and Farmer's Wife; and president, National Farm Chemurgic Council.

growing reality as long as its foundation of liberty stands unimpaired.

Plenty for man, plenty of food and of the innumerable riches of nature, has been the gift to humanity of a type of man unique among his kind.

Ever since the primitive anthropoid noticed that the stars change their places in the heavens, there have been philosophers; but the philosophers with all their theories failed to lead man to the realm of plenty.

Ever since one tribe of men discovered that another tribe had more than they, military chieftans have come forward. But the generals with all their clubs and cannon and stratagems have always left the earth with less than it had before.

The politicians have worked their ways to eminence and power and renown, and have beguiled the historians to write their fame in imperishable print. Nevertheless, hunger still presides over a wider realm than the greatest of kings or statesmen.

In free America, and never until there was a free America, came the flowering of that type of man who held the key to abundance for his fellows on earth. He holds that key today.

Before Liberty was proclaimed in 1776, before it was established at Yorktown, before it was truly launched under the Constitution, men of his type were unsafe wherever they lived. They were subjected to inquisitions, taunted by the philosophers or executed as was LaVoiser by the statesmen.

When Liberty prevailed, this man emerged. He had no theories, no stratagems, and little guile. He was free to prove that his was truly the key to production and plenty for mankind.

Who is he? He is the man who builds his case on proved or provable facts. In plain modern English we call him either a scientist or an engineer.

Theories, and poverty for those over whom the theories held dominion, have been associated through all the centuries. Only those theories have been productive of national wealth or social advance which have coincided with provable facts.

As long as the flat-earth theory prevailed, the riches of the western continent were unknown to eastern man. Columbus proved the round-earth theory, and opened up the Americas. Wherever crops are planted according to theories, poverty-yields result. Crops fertilized with facts provide output in plenty.

A marked distinction may be remarked, incidentally, between a theory and a hypothesis. A hypothesis is a theory which a scientist may accept until he can establish the facts to prove or disprove it. A theory is usually an idea which its advocate forever seeks to prove and to which he will cling even in the face of facts.

ENGINEERS AND SCIENTISTS ARE THE PRODUCERS OF PLENTY BECAUSE THEY ARM THEMSELVES WITH FACTS

The engineer and the scientist are producers of plenty. They arm themselves with facts.

Because they are production men, I wonder if the time may not be coming when the hungry world can be persuaded to lay aside its faith in theorists and to place its trust in fact-men.

Facts, once enough of them are assembled, can conquer poverty. Theories will only perpetuate it.

The facts that man requires are simply the facts of nature. Whenever he discovers new facts about the matter of which the universe is made, and new facts about the laws which govern that matter, he enlarges his productivity. The engineer and the scientist have organized the facts of nature into the power that has enlarged man's muscles until the work he can do now produces in multiples of his past output.

The world's hunger today is the consequence of failure to use the facts that already have been established.

The agricultural engineer, supported by his fellows in agronomy, in animal husbandry, and by his associate appliers of facts, has the answers to age-old problems which neither statesmen nor their philosophers nor their generals have yet discovered. He can feed the hungry.

The business of the agricultural engineer is to augment the cornucopia of plenty. In every department of his profession, his efforts are bent toward adding to the supply of food and to the abundance of agricultural wealth, toward reducing the effort and cost of its production, toward improving the quality and distribution of the harvest.

The agricultural engineer is engaged with improving the plow that turns the soil, with better tools of cultivation, with implements for a more perfect harvest. He built and has steadily improved the tractor. For the first period in human history the hard work of food production no longer depends entirely upon the muscles of men and animals.

Seizing upon the magic force of electricity, the agricultural engineer has adapted its flexible light and power to hundreds of methods that multiply the muscles and ease the toil of farmers.

The agricultural engineer drains the swamps and sloughs and turns them into the richest of agricultural land. He taps the stored waters of the mountains, levels the floor of the desert, and creates vast new areas of blooming farms. He builds terraces which restrain the impoverishing onslaughts of erosion, and preserves the fertile topsoil of the centuries so that it may feed the hungry of the future.

He designs the barns and storehouses and processing sheds, improves the fences and work structures, all for the greater abundance of food for the world.

In the institutions of practical education he shares his knowledge of productive ingenuity with youth, and inspires his students to devise means for greater prodigies of production.

I have not overstated the functions of the agricultural engineer. I have merely tilted the emphasis over toward the true objectives of the activities which are listed in the prosaic prospectus of your profession.

When a statesman of the usual sort finds himself in charge of a country after this war has ended, he will likely either start the chain of events which will lead to another war, or he will tax the people to desperation and renewed hunger. There is little hope for the world in repeating the theories of the past.

THE AGRICULTURAL ENGINEER CAN MEET THE FOREMOST NEED OF THE HUMAN RACE — MULTIPLIED PRODUCTION

Perhaps it would be wiser to put the agricultural engineer in charge. He would hire no economists, no philosophers, and few lawyers. He would put tractors to humming in the valleys. He would store up the waters, drain the swamps, run a grid of highlines, analyze and fertilize the soil, send for the best bred strains of crop seeds, and by the second autumn probably would have created a farm-surplus problem. That problem, however, would be temporary because, until world production has been doubled and redoubled many times, a surplus of one commodity can only mean that not enough of some other commodity has been produced to earn the medium for exchanging the two.

I do not mean to be facetious. I am in dead earnest in asserting that when production, multiplied production is the foremost need of the human race, common sense demands that the kind of men who understand the arts of production must come into larger authority. The engineers and scientists may not be equipped to administer all the duties of governors, but governors ought to do no less than to encourage the engineers and scientists to go to work on this old earth and make her yield up at least enough to satisfy the physical hunger of the human race.

The copious and exuberant blunders exhibited by the bureaucrats of Washington have sanded the gears of our own food production machine until, now in the time of the greatest need, we face the possibility that even with two kinds of money it will be hard for the urban family to find a square meal. After irreparable damage has been done, Washington is only beginning to discharge a few of the theorists and to put an occasional engineer or other fact-man into small authority. Unless in the administration of our own country there comes soon to be a reasonable regard for the facts of nature, and a reasonable respect for the engineers and scientists, we in rich America are in danger of retrograding into the lower levels of want and hunger.

If an engineer were called upon to design a food production agency for this country at war, he would surely not go at it as has been done. He surely would not put nine drivewheels in nine different areas of the government, with a separate driver for each wheel, nor would his drivewheels be shaped so as to be indistinguishable from the brakes. Yet it is with some such fantastic contraption that the federal aspects of food production are being managed. Until the food powers (Continued on page 230)

Wartime Strategy for Agricultural Engineering

By M. L. Nichols
FELLOW A.S.A.E.

THE RAPID change from peacetime economy to a condition of total war has affected every phase of our lives. Agricultural engineering organizations have been particularly affected as the engineer's ability to perform many different kinds of tasks has resulted in his efforts being directed to many diverse objectives. It is unnecessary to enumerate these activities to the American Society of Agricultural Engineers, but this dispersal, together with the restrictions on the use of materials for building, rural electrification, and machinery, has had a serious effect on the agricultural engineering work.

Unfortunately, at the very time of the attack on the United States the research work in agricultural engineering, together with that of other agencies in the federal government, was in the process of reorganization with the general objective of establishing closer working relationships between several of the government bureaus. The fact that the completion of the new organization of the work was delayed by pressure of the war effort has caused considerable concern to many members of A.S.A.E. who have business relationships with various phases of the work in Washington. The conversion of the implement industry to war production, the reduction of teaching in the colleges, and lack of materials in the buildings field occurring simultaneously, have accented the need of some central and official headquarters for clearance of the business of the Society.

It is my understanding that in the subject assigned me — "Wartime Strategy for Agricultural Engineering" — it was intended that I should present my viewpoint as to the most practical method for developing such a coordination in agricultural engineering activities, in accordance with national needs, and propose some central organization so that the profession could have a clearing and contact point in Washington. I feel that the Society is quite properly interested in this since industry, in supplying agricultural equipment, has great need of sympathetic and definite channels of contact with the Department. And the professional personnel, particularly those in the departments of the state institutions, may have serious problems in maintaining their organizations if some such arrangement is not effected. It is not, however, within my competence as an employee to state what the organization of the Department will or should be, but as a member of the profession who is administratively responsible for a portion of the work of agricultural engineering in the Department, it seems proper to suggest how such an end can be obtained under the organization now existing.

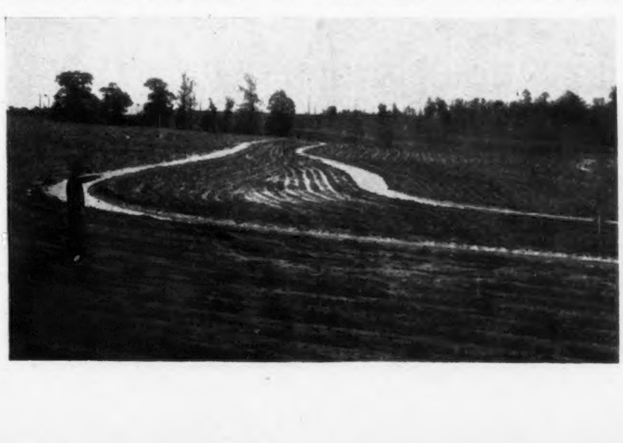
Let us first consider the situation in agricultural engineering as it now exists. It is quite necessary that the Society recognizes the opportunities created by the merging of the activities of the agricultural engineer with those of other agricultural sciences. When one considers the objectives of agricultural engineering, the present organization and arrangement is quite favorable to the development of the technical activities of the profession. The main objective of agriculture is the production of food, feed, and fiber crops, in which must be considered the development of necessary facilities and techniques to produce these efficiently and economically. This includes the development, maintenance, and operation of various kinds of farm equipment, buildings, and supporting services to the farm, such as rural electrification, water supply for irrigation, drainage outlets, schools, highways and health, and recreational facilities.

Under the previous organization of the Department, the work of the bureaus was often not coordinated as thoroughly as might have been desirable for attaining many of the agricultural objectives. In many cases, to avoid overlapping and duplication, sharp and distinct lines were drawn between the permissible activities of various agencies. For example, the drainage engineer could not work with crops or soils, or the irrigation engineer with the water requirements of plants. This situation in many cases prevented effective cooperation among technicians. Under these conditions, the work of the former Bureau of Agricultural Engineering did not play the important part in American agriculture that its science deserved. I do not feel that the administrators of the bureaus should be particularly criticized for this condition, for, in general, the condition in the Department was no worse than in many of the state institutions or in many private industrial firms. In fact, the Department is often under review by the Congress in order to prevent overlapping and duplication, and administrators must be constantly on the alert to avoid any such actual occurrence.

It must be remembered that the Bureau of Agricultural Engineering was set up as a research bureau. Reorganization of the research of the Department under the direction of an administrator was designed to bring about an effective coordination of the research so as to obtain practical results, considering simultaneously all of the factors entering into a farm problem. Under these conditions, the agricultural engineer very properly finds himself associated with soils and crop scientists and under one administrator who has complete authority to include all the factors necessary for making research effective. Through the office of the administrator, those engaged in research particularly concerned with action, or in investigations for developing agricultural engineering techniques, find that this condition materially increases their efficiency by bringing them more support of the other research groups of the Department without breaking their connection with the field action program. While the pressure of war has delayed the full fruition of this general plan, it has already proved to be of considerable benefit.

As I see the potentialities of this development, agricultural engineering will become an integral part of almost every program of the Department, as it properly should be. For the first time, the agricultural engineer has the opportunity to avail himself of the full technical resources of all branches of science. The only limitation which I can see is that of the individual to see, grasp, and develop this opportunity to its fullest extent. If the development of this opportunity is accepted as the best strategy for the profession, we can look forward with confidence to an increased effectiveness in the field of agriculture in the United States and elsewhere.

There still remains, of course, establishment of some central clearing and contact point for the profession in the Department. There are many ways in which this can be effected. In my judgment, how it is done is of decidedly secondary importance as long as it is done. The best strategy obviously is to work out such a mechanism directly with the Administrator of Research and representatives of other agencies whose work employs agricultural engineers. It would seem that the general basis for such an understanding should be that the primary function of the agricultural engineer is to implement and develop practical methods of putting into effect the science of agriculture, not as an isolated group but in cooperation with other technical groups working directly in the field of agricul-



An address before the annual meeting of the American Society of Agricultural Engineers at Lafayette, Ind., June, 1943. Author: Chief of research, Soil Conservation Service, U. S. Department of Agriculture.

ture. Such a definition of the agricultural engineer's function would, of course, approach the European definition of an agricultural engineeer and in practice would include many who are primarily trained in soil technology and agronomy, but who are engaged in organization and implementing action programs.

Another point which seems to be of considerable importance in the strategy of the moment is the further strengthening of state and federal relationships. Regardless of our individual viewpoints as to what these relationships should be, we all recognize the fact that total war requires a highly centralized government and that at the moment, we *are* at war and *do* have a centralized government. While we are not concerned as a Society with controversial viewpoints as to the spheres of authority of state and federal agencies, we should be much concerned that we do have representation in the national government of such a kind and disposition as to provide ready exchange of services with the various state agencies and industries serving the nation.

The federal agencies should also be concerned that they are properly represented in the states. Personally, I have found that it is mutually profitable and acceptable to have the men engaged in research activities for which I am administratively responsible established in the state experiment stations and to have them conduct their work as representing both agencies in a mutually agreed upon program. Such a course involves mutual confidence, understanding, and joint support of the unified program.

The national program, under these conditions, is the combined program of the 48 states, and the national agency becomes not a central authority but a central service unit and clearinghouse for the cooperative undertaking. The service is most effective to the farm people within the state since they are working with and through their own institutions. The interest of such a cooperative setup should encompass service not only to farmers and ranchers, but to all agencies dealing with agriculture. In this connection, it should be noted that real leadership resides in men and we should try to develop this leadership regardless of institutional lines. In many cases we are looking for guidance in the cooperative program to men in the state institutions, and they are usually delighted to perform as wide a service as possible as long as it does not conflict with their required service to their own states. Such leadership is frequently found in private industry and should be utilized in national programs wherever private interests do not conflict with public interests. The point I am trying to make is that for any strategy to be effective, we must achieve a high degree of coordination and cooperation within our own profession. We must have a program and we must be united in its support. This requires planning and leadership in carrying out our plans.

MOST COUNTRIES DESIRE TO INCREASE THE EFFICIENCY OF FARMERS BY AMERICAN MACHINERY METHODS

As a case in point of the necessity of planning, I will mention a few things which came to my attention at the conference on food and agriculture at Hot Springs. Forty-four nations participated in this conference which dealt with the very practical subjects of nutrition and methods and means of increasing the food supply of the United Nations. With one or two exceptions, every nation represented expressed the desire and need of greater agricultural engineering development. Representatives of those nations which have been invaded expressed a desire for American farm machinery to follow immediately the army relieving them, so as to put all available crop land into food production immediately. A delegate from Yugoslavia expressed the hope that they could use the jeeps of the relieving force for land preparation, since their work stock and tools had been carried off by the Germans. Many of the countries desire to develop immediate water supplies for irrigation. Other areas require drainage. Many need farm sanitary facilities. Most countries wish to increase the efficiency of their farmers by American machinery methods as far as their conditions permit.

There is great need of soil and water conservation work throughout the world. Flood control is a necessity for many areas. Many nations want American-trained-men — agricultural engineers chiefly — and they state quite frankly that they do not want simply construction engineers, but, rather, men who know agriculture as well as construction. This looks to me like an opportunity for development in the agricultural engineering profession and it would seem good strategy for the Society to determine how it can grasp this opportunity of world leadership and begin to train young men for it. The strategy of such a move from the viewpoint of the industrialist and manufacturer is obvious.

There are many other opportunities for development of the profession, if the Society sees and grasps them. In the offing is a greatly increased attention to drainage; the development of small water facilities in the West; irrigation in the East as a sound method for crop insurance; and many others.

Agricultural engineering is going to be just about what we make it. In my judgment, if the base of our activities is broadened and the profession is allied with general crop production and soil management, as I have indicated seems to be the intention in the Department of Agriculture, the only limiting factor that I can see is the breadth of our vision and our ability to coordinate our efforts for achievement.

Machinery Problems of Mulch Culture

(Continued from page 226)

as in treatment (e) probably reflects elimination of the remaining unfavorable factors, namely, poor aeration and failure to invert the upper layer of soil.

Separate studies were conducted on some of the refinements of mulch culture practices on corn land, on Clarion soils only. These indicated that depth of preparation of seedbed, within the range 3 in to 7 in, was unimportant; that there was no advantage to be gained by compacting the lower layers of the seedbed; and that while stand and yield might be improved somewhat by shredding the residue rather than by breaking it with a stalk cutter, probably the difference could be made up more economically by leaving the residue coarse and increasing the rate of planting slightly.

When interpreting this single year's results, the weather conditions should be kept in mind. June and July rainfall were respectively 65 and 71 per cent higher than normal. August rainfall was about 90 per cent of normal, but during the 30-day period July 27 to August 25 inclusive no rain as much as ¼-in occurred.

The Agricultural Engineer's World

(Continued from page 228)

are centered in one competent man, production will be hampered and there will be less food with which to meet our obligations.

A modern war is bound to be won by the side with the greatest resources of men and materials and with the ablest and freest technologists. The only certainty of a durable peace may also rest with the technologist. It is demonstrable that his are the only skills which will produce in abundance, from the materials which nature has provided, the food and goods which are the desire of mankind.

Poverty, the lack of food and goods, may not be the only cause of wars. I will venture, however, as a reasonable hypothesis, well worth the most vigorous efforts to explore, that a substantial increase in production in all lands will guarantee peace more firmly and for longer than any other course that will be proposed. The technologist possesses and knows how to use the facts to bring about such an increase. Virtually every area of the earth has more resources than it has used. There is always the air, the rain, the sunshine and the soil from which to manufacture the raw materials of wealth. The great statesmen of tomorrow will be those who give a free hand to the technologist and the business man, with encouragement to produce enough to foreclose forever on hunger and want.

More Engineering

IN WAR, as in peace, the philosophy of scarcity is fallacy. The right answer always is to produce, not to do without. The profession which promotes production is engineering. While the politician subtracts, and the demagogue divides, the engineer multiplies. Now, as never before, America needs more engineers, more engineering, more heed of its principles.

Irrigation and the War Effort

By Ivan D. Wood
MEMBER A.S.A.E.

A GREAT deal has been said and written during the last few weeks about turning on the faucet of agricultural production to meet the food demands of the war effort. It was conclusively shown during the last World War that overall increased production or ever increased production of certain critical crops is not too easy to obtain when it is necessary to readjust the assembly lines of six or seven million farm factories whose output is dependent upon waning man power, scarce equipment, and uncertainties of the weather. During 1942 the wind was at the farmer's back and with the help of a very favorable season agricultural production hit an all-time high of 27 per cent above normal and 13 per cent above the former peak year of 1937.

There have been many reasons why the seriousness of the food situation has not hit home sooner with the bulk of the American people and even with many of the home front planners as well as newspaper columnists and even the agricultural press. It is well to remember that the years after the first World War saw great surpluses build up in many farm commodities due in part to underconsumption of many families who subsisted rather than lived on diets almost devoid of meat and fruits. During all this period farm programs stressed crop control. Not until rationing appeared could many realize that the days of plenty had gone glimmering.

Even though generous deferments from military service are now offered to those engaged in agricultural pursuits, the program started after many young men were gone as is evidenced by a survey made on the Central Nebraska Public Power and Irrigation District near Holdrege, Nebraska. On this project there are 1150 farm units with a total of 175,000 acres. From the 1150 farm units 358 young men have gone to the armed forces; a like number have gone to war industries and the average age of the farmers remaining is now 57 years. This simply means that two farms out of three have lost the hired man. The survey showed that only 310 young men and boys over the age of 10 years remain to take over the farming duties of 1150 farm units. It has been estimated that old age and death may remove as many as 300,000 farmers per year from this vital war industry in the United States.

Other reasons why a greatly increased agricultural production may be difficult to obtain are: Shortage of specialized equipment for raising potatoes, beans, sugar beets, and flax; and the reticence of farmers to take up new practices with which they are not familiar. Then there has been no Navy "E", or even an "A" for agricultural workers even though the farmer and his whole family have toiled 12 to 16 hours per day with no overtime pay, only to be named one of the main factors in the high cost of living. There must be developed a feeling for the importance of food in the war effort and those engaged in the business of producing it must be given the same consideration as the man who builds the aeroplane or the tank. There must be no stigma attached to those deferred for agricultural production.

It is also a significant fact that at the time when food shortages loomed on the horizon the development of irrigation projects all over the West was stopped and agencies charged with such development lost months of valuable time and personnel which cannot be replaced. During this same period irrigation engineers were being recruited here for use in foreign countries where irrigation was recognized as a means for quickly increasing the food supply.

Paper presented at the annual meeting of the American Society of Agricultural Engineers at Purdue University, June, 1943. A contribution of the Soil and Water Conservation Division.

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It should not be necessary to dwell at length on the importance of the food production problem. However, attention may be called to the fact that we have 10 to 12 million more mouths to feed than in 1930 and this is about equal to the entire population of Canada, and, aside from our own country, for years to come we may be called upon to feed the world until war-torn fields now under domination of the Axis powers and the man power to farm them can be rehabilitated.

There is a significant reason why increased production by irrigation is important at this time. West of the 100th meridian are 17 states whose population has been swelled by 3½ to 4 million persons, or in other words, the equivalent of three or four states as large as Nebraska have been moved into the territory due to the concentration of troops and persons who have gone there to work in defense industries. Food for these extra millions certainly should be grown as near as possible to the point of consumption and not be shipped in by rail to swell the load on an overtaxed railroad system.

The migration to these western states from the Middle West was significant during the years of drought and depression. The 1940 census showed a loss of more than 300,000 persons from North Dakota, South Dakota, Nebraska, Kansas, and Oklahoma. It is more significant that the loss since 1940 has been as great or greater according to unpublished estimates obtained from the Office of Price Administration consumer registration in those states.

The stupendous job of keeping the great horn of plenty full to overflowing so that all food items will not be rationed is one which will tax the efforts and ingenuity of every farm family and every agency, both state and federal. The problem resolves itself logically into two phases each of which is so complex as to warrant study by all engaged in food production. In this paper I can but suggest in a small way some of the possibilities in the irrigated West which would seem to hold out some hope.

It is well to recognize that there are two ways in which total overall production can be increased, namely, (1) by increasing production on existing farms, and (2) by bringing new acres into production.

In this effort the West with its 20,568,000 irrigated acres can play an important part. The potential feeding power of irrigated land is shown in the fact that the 20½ million irrigated acres represents only 3 per cent of the land in farms, yet produces 30 per cent of the West's crop income and that the per acre value of all crops grown in the United States is $22.32 while for irrigated crops the per acre value is $61.50.

Food production potentials in the irrigated West are reflected in the astounding fact brought out by the 1940 census, that works are now constructed for 7 million acres of land not now being irrigated, and we are told by the Bureau of Reclamation that there is water available for irrigating an additional 22 million acres as well as furnishing supplemental water for 11,700,000 acres, or 85,000 farm units now facing a water shortage. It is true, of course, that not all of these potentials can be realized in the present war

effort. Some of the projects are not feasible from the standpoint of producing food for this war, but certainly the development of some part of the West's irrigation resources will produce quick and noteworthy results, and before we are definitely over the hump in food production we may be faced with the problem of producing critical crops at any cost.

It would seem that the American Society of Agricultural Engineers is a logical group to suggest to those in authority what should be done and how it can best be accomplished. The possibilities for food production by the development of irrigation should be surveyed by unprejudiced eyes. No agency, private or public, should use the stress of war emergency to further private gains or advantages. There are no doubt many projects without sponsors which could contribute greatly to food production if man power, farm machinery, and land development could be had.

Increasing Production on Existing Irrigated Farms. A pilot study conducted in the Yellowstone Valley of Montana in 1943 in which many irrigation farmers were contacted pointed out eight ways in which production on existing irrigated farms can be increased according to the opinion of the men on the land. They are as follows: (1) Increasing soil fertility, (2) improving land drainage, (3) leveling rough land, (4) control of noxious weeds, (5) selection of better yielding crop varieties, (6) improving water distribution method, (7) extending existing irrigation work, and (8) use of supplemental water.

Not all, or perhaps any, great number of these cures are needed on any individual farm, but to secure the adoption of better practices on any great number of farms is a problem which can not be solved easily. More attention must be given to low-producing farms and an effort made to discover why they are low producers and what can be done to raise the level of yields. It must be recognized that the high yields obtained by the best irrigation farmers and by experiment stations are not due entirely to controlled factors such as fertility, water application, etc., but are due in part to unmeasured factors as labor efficiency, operator ability, land preparation, better adapted equipment, better timing of field work, and a certain "know how" which can not be measured and is acquired by some after years of experience and never acquired by others.

Some of the factors as increased soil fertility which make for increased yields can be accomplished only over considerable periods of time. Legumes can not be grown and plowed under in a season, nor can barnyard manure be produced in greater quantities without additional livestock. The removal of alkali from fields by drainage may require years before full results are accomplished.

SOME LAND NEVER IRRIGATED COULD BE BROUGHT INTO PRODUCTION QUICKLY WITH THE PROPER EFFORT

Certain practices and combinations of practices on presently irrigated farms do hold out considerable hope for increased production. It has been shown from studies conducted in the Yellowstone Valley of Montana that some 15 per cent of the irrigable area on the project is not presently being irrigated. Out of 94 farms studied, 36 had an average of 53.8 acres each of additional land which could be brought under irrigation. Some of this has never been irrigated and some has been but is not now being irrigated due to a variety of causes. Approximately 52 per cent needs leveling, 36 per cent needs repairs to ditches and structures, and 20 per cent needs ditch extension, while only 4 per cent needs clearing. According to farmers interviewed in many sections of the West, much of the land could be brought into production quickly if proper effort was expended.

Since the amount of land on each farm is small, much of the work could be done with the farmer's own equipment and management. In most instances, more intensive use of the farm machinery and labor would take care of the additional farming operations. Along the Yellowstone River in Montana alone it is estimated that 20,000 additional acres could be made productive in two years if the proper incentive were present to encourage such development. West of the 100th meridian there is no doubt an area of between 2½ to 3 million irrigable acres on irrigated farms which is not being irrigated which could be brought into production in a two-year period.

How this might be accomplished is a problem which challenges the imagination. Various solutions have been suggested as follows: (1) Incentive payments, (2) better prices for agricultural products, (3) educational campaign with patriotic appeal, and (4) making technical services and land development equipment easily available. No doubt a combination of these things will serve to give the desired results. It has been suggested that local war boards, with the help of local AAA offices and other agencies, single out low-producing farms and spot irrigable areas which are not being irrigated on farms of each county and then offer all possible assistance to the operators of those farms. A patriotic appeal to the best farmers of a community to help less successful neighbors by offering advice, ditching equipment, land leveling equipment, etc., might bear good fruit. The large number of farm units and operators involved, the diversity of the problems to be met, and the shortage of trained technical help offer some complications in this line of development.

Increasing Production by Supplying Supplemental Water. There are scattered throughout the West many existing projects on which the limiting factor in crop production is the lack of water. These may vary in size from a few hundred acres to the Colorado Big Thompson which involves 320,000 acres. In some cases only better diversion works are needed; others require more storage capacity, or, as in the case of the Big Thompson, water from one watershed is diverted to another. In other cases water could be diverted from poor land and used to supplement the flow to good land. Such projects often would pay good dividends in food production since the individual farm unit is usually manned and equipped and the amount of critical material involved in construction is small compared to the benefits obtained. The Department of Agriculture has suggested for wartime consideration projects of this type amounting to 55,000 acres. The total of such projects under construction, approved for construction or proposed by the Department and other agencies at present amounts to approximately 2,109,000 acres. Such projects should receive careful appraisal to determine the returns which can be expected for the amount of critical materials used and the rapidity with which increased production can be obtained.

INCREASED PRODUCTION CAN BE HAD ON PROJECTS WHERE WORKS ARE BUILT BUT LAND IS UNDEVELOPED

During the depression years when labor was plentiful the Public Works Administration and other agencies constructed some large irrigation works some of which were so complete as to bring the water to each farm unit. Typical is the Central Nebraska Public Power and Irrigation District which involves 175,000 acres as yet only slightly developed due to labor and machinery shortages, and unfamiliarity of the dry-land farmers with irrigation practices, new crops, and new cropping methods.

On this particular project in Nebraska the water is available, the soil is the best, and climatic conditions are excellent for growing critical war crops; but the farmers, as has been said, are old, the average age being 57 years. The young men have gone to war or to defense industries. The cropping pattern is adapted to dry land farming with which the present owners are familiar. Yet great potential food production is possible with proper organization. One hundred and seventy-five thousand acres on which production can be increased 300 per cent is worthy of consideration.

Needed for the job are some of the following activities: (1) Group organization, (2) additional farm labor and equipment, (3) technical services, and (4) land development, leveling, etc.

In order that groups of farmers can operate as a unit to secure the benefits to be derived therefrom, water users organizations, conservancy districts, or other like organizations may be formed. Such districts will be in a better position to secure governmental aid in the form of technical advice, rental of heavy dirt moving equipment, and other services from various governmental, state, or private agencies, than would an individual farmer.

Food Production from New Projects. As has been pointed out before water is available for approximately 22 million acres of new irrigated land. No doubt many projects could be completed in time to aid in the war effort, but the building of dams and canals, siphons, and structures to get water to new raw land does not in itself mean food production. Before food rolls off the assembly lines, the new land must be cleared of sagebrush and leveled. New farm laterals must be built and conditioned. Operation and maintenance of the new system must be organized; and settlers moved on to the land and taught the complicated processes of irrigation. Before a new project is cleared (Continued on page 234)

Effect of War on Engineering and Engineering Education

By A. A. Potter

WE CANNOT fully appreciate the effect of the war upon our profession unless we first reflect upon these questions: Why are we at war? What factors contribute to victory in modern warfare?

The answer to the first question is that the totalitarian tactics of the Nazis and the Japs cannot live side by side with the idealism of the United States of America. Where the Nazis and their cohorts stand for lies, slavery, and arbitrary gangster rule, this great country of ours stands for truth, liberty, and law; where the Japs and the Nazis encourage the worst type of sadistic cruelty and limit opportunities to the members of their gangs, our nation has always stood for humanity, tolerance, and equality of opportunity; where our unscrupulous enemies stand for government by cruel and dishonest gangster-dictatorship which has no respect for human or property rights, our people have a government by consent of the governed, reinforced by the Bill of Rights. The war we are now engaged in is a matter of life and death for liberty, humanity, honor, and for the other ideals which have made this country the greatest nation in history.

The answer to the second question is modern mechanized warfare. Modern mechanized warfare is a test of the relative engineering, scientific, and production skills of nations. From time immemorial engineers have rendered valuable service in warfare. In fact, the term "engineer", until fairly recent times, was applied mainly to those who were concerned with engines of war. The present conflict has greatly increased the demand for engineers and scientists. New scientific techniques, new war machines, and new materials have to be developed to serve the needs of the armed forces, of war industries, and of the civilian population. Since the spring of 1940, particularly since the treacherous attack by the Japanese at Pearl Harbor, many problems have challenged the ingenuity of our profession.

Our former abundance of raw materials now seems like a mirage, as acute shortages have developed which have seriously threatened not only industry and civilian needs, but also our entire war effort. It is to the lasting credit of the American engineer that our country has been able to overcome these threatened shortages by developing substitute materials, by better integration and utilization of existing facilities, and by improved management. Our country is now producing war materials never matched even by our unscrupulous enemies after years of preparation and after utilizing the outmost effort of the countries they have enslaved. The public at large is beginning to realize that American engineers can do most with least in the shortest possible time. Never before, in war or peace, have the members of our profession commanded such general public respect and exerted such influence as they do today.

Great as the contributions of the engineer have been during the present emergency, there is a strong feeling among those in high places in connection with the war effort that as a profession we have not presented a united front as has the medical profession, and that outside of purely technical matters engineers are not exerting a strong group influence in national affairs. Some of the plans now under way will result in seriously interrupting the continuing supply of qualified engineers needed for the war effort and for the postwar period. Attempts have been made by the separate engineering societies to call this matter to the attention of our government, but the results have been negligible, since a profession cannot be represented by numerous societies, each wording resolution to serve its distinctive needs.

For about twenty years the engineers had a mouthpiece, the American Engineering Council, of which the American Society of Agricultural Engineers was one of the most active members. The American Engineering Council, by assuming leadership for our profession in matters pertaining to public welfare and of joint interest to its member-societies, served the engineer and the public. Unfortunately engineers who are supposed to be experts in management failed to appreciate the value of cooperation among engineers and of a spokesman for our profession; the American Engineering Council was disbanded at a time when the need is greatest for us to think, act, and appear as a well-knit and well-coordinated professional group. In the interest of the war effort and of postwar problems which are also bound to be most serious, engineers should either revive American Engineering Council or utilize one of the other engineering functional agencies, such as the Engineers' Council for Professional Development, to bring about more effective cooperation and united action among engineers in matters pertaining to the war effort and in other things relating to public welfare.

During the first world war the engineering colleges of the country limited their training for war effort to less than college grade instruction. The Vocational S.A.T.C. was only concerned with the training of mechanics, and the collegiate S.A.T.C. did little to add to the number of engineers for the war effort. In the spring of 1940, when it became evident that this country would have to be a leading factor in supplying war equipment for the armies of the allied nations, the government was advised to utilize the engineering colleges for training on the college level and for research of value to the war industries and to the armed forces. Since the summer of 1940 some of our engineering colleges have given instruction on the less-than-college-grade vocational level, either through the vocational programs of their states or at the special request of the armed forces. Several engineering colleges were selected by the Navy for specialized training on the less-than-college-level because they had adequate facilities for housing and for feeding of large groups of sailors.

In general, however, our engineering colleges, through the EDT, ESMDT, and ESMWT programs, under the auspices of the U. S. Office of Education, have been giving or are giving training largely on the college level. Through these programs they have benefited the war effort up to date by adding over one million people with specialized knowledge in the fields of engineering, science, and management. The colleges have not only contributed to the war effort through specialized training but have developed through ESMWT contacts with the industries of their localities which should prove helpful to them in enhancing their educational and research contributions to industry and the public. It is hoped that the experience which our engineering colleges have gained through the war training programs will be capitalized by them during the postwar period, not only in improving their regular programs of study leading to degrees, but also in establishing a large number of technical institutes all over the country with intensive practical programs closely linked to the needs of industries in the communities.

While the War Training Program in Engineering, Science, and Management, under the auspices of the U. S. Office of Education, is meeting a critical need for specialized technical personnel, the shortage of fully trained engineers for service to war industries and to the armed forces is becoming more and more acute. The majority of our engineering colleges are attempting to alleviate the shortage by operating on a continuous year round or expedited plan. This plan, by reducing vacations to a minimum, makes it possible for a high school graduate to complete the requirements for a bachelor's degree in engineering in about two and two-thirds years, instead of four years, and without an appreciable lowering of standards. This expedited plan is mainly a device for making engineering graduates available earlier, but is adding very little to the total number of engineers. The National Roster of Scientific and Specialized Personnel of the War Manpower Commission estimates that 40,000 to 50,000 additional engineers will be needed during 1943 and that potential college production during the current academic year is only about 17,000. The above estimate does not include an allowance for the replacement of engineers entering the armed forces in non-engineering capacities; neither does it take into consideration the fact that a considerable number of the engineering graduates of this year's class will serve their country as aviators and in other non-engineering military and naval assignments.

An address before the annual meeting of the American Society of Agricultural Engineers at Lafayette, Ind., June 1943. Author: Dean of Engineering, Purdue University.

Both the Army and the Navy will make considerable use of engineering colleges through the Army and Navy Specialized Training Programs. One thing is certain, however, and that is that our educational institutions of higher learning "will not be taken over by the government." The A.S.T.P. involves a prescribed program for all trainees who are being selected from the enlisted personnel in service. This program consists of a three-term basic curriculum followed by several terms of advanced instruction. Each term is twelve weeks in length, and trainees may remain one to seven terms. There is no dependable information as to numbers which will be sent to engineering colleges under this A.S.T.P. plan. The Navy Plan is more definite.

Those now enrolled in V-1 or V-7 will be enabled to continue their present programs after induction to graduation if they major in aeronautical engineering, civil engineering, mechanical engineering, or electrical engineering, providing the students in these fields have been selected for specialist services. Those in V-1 and V-7 who are enrolled in engineering curricula other than aeronautical, civil, electrical, and mechanical engineering may transfer to the prescribed V-12 program or may remain in their present curricula, providing they include the minimum requirements in the civil, electrical, or mechanical engineering curricula. Students in V-1 and V-7 may be allowed to remain in their present curricula other than civil, electrical, and mechanical engineering for a short time, but not to graduation.

The Navy College Training Program has sixteen-week terms in place of the twelve-week terms prescribed by the Army. All new students in the N.C.T.P. will be enrolled in a prescribed program and placed in V-12. It is expected that the product from the prescribed Army and Navy curricula will not be as well prepared as are our present engineering graduates, although the soldiers and sailors sent to college will have been carefully selected through certain screening tests and will have no financial worries, because the government will pay their tuition and subsistence in addition to their Army or Navy pay.

AN "INDUSTRY RESERVE" OF ENGINEERS IS NEEDED TO PROVIDE AN ADEQUATE SUPPLY FOR WAR INDUSTRY

While the A.S.T.P. and N.C.T.P. may make available a large number of fairly well-trained technicians for the Army and Navy, the need for engineers on the part of the war industries is bound to become more and more critical. The engineering colleges will no doubt be used to capacity for special training for the armed forces, but unless the war industries make their wants known to our government the supply of engineers for industry will be greatly curtailed. The engineering colleges of our country must continue to be the major source of replacement supply of engineers for the planning, design, and mass production of armaments and munitions of war. Selective Service has been fairly liberal in deferring engineering students, but unless Selective Service Occupational Bulletin No. 11, amended March, 1943, is changed so that the period of deferment is extended beyond July 1, 1945, a serious gap in the continuity of supply of engineers will develop very shortly. In general, the needs of our war industries will not be fully satisfied unless an "industry reserve" or some other scheme is set up to parallel the A.S.T.P. and N.C.T.P., for the purpose of increasing an adequate supply of engineers for war industry.

Summarizing the views expressed in this paper, the influence of the engineering profession depends upon our ability to present a united front in matters pertaining to public welfare. This cannot be accomplished by one superengineering society. We must have a large number of engineering organizations to further technological advance in the several specialized fields of our profession, for improving practices, for dealing with matters pertaining to engineering education and standardization, and for providing forums for the discussion not only of problems of technology, but also of the economic and social phases of engineering contributions. In addition we must have some functional organization of the engineering profession, such as American Engineering Council or the Engineers' Council for Professional Development, so that engineers may be able to serve, through united action, their own profession as well as the public at large.

Engineering education must be geared to the war effort, but the needs of the war industries must be recognized by the establishment of an "industry reserve," or our Selective Service regulations must be modified to insure a continuity in the supply of engineers. The war must be fought to a victorious finish, and this cannot be accomplished unless there is an adequate and continuous supply of engineers for service in the armed forces and in the war industries. We must also keep in mind the requirements for engineers in the postwar period, realizing that engineers cannot be fabricated over night.

Irrigation and the War Effort

(Continued from page 232)

for construction careful scrutiny should be given to determine if it should receive priority for food production or shelved for the postwar era when public works will be needed.

It appears that man power shortage is one of the serious handicaps in the development of new lands on all types of irrigation projects. At this time new settlers would be difficult if not impossible to obtain. To overcome this difficulty, the farming of large tracts of newly developed irrigated land by the use of war prisoner labor and large motorized equipment has been suggested. Such farming operations might be carried on by associations, corporations, or private individuals. Irrigated land in most parts of the West is well adapted to major shifts in cropping practices. It is not too difficult to change from one crop to another quickly and most of the badly needed products can be grown there. One Case-Wheeler project developed in Montana consisting of 12,000 acres of irrigated land produced 30,000 bu of flax, or 80 per cent of the flax increase asked for in 1942 goals for the entire state.

In the stress of the war emergency there will be a tendency for farmers to plow for cropping purposes land which has been seeded to legumes and grass to prevent wind and water erosion. Even now some marginal and submarginal land is being broken for grain production as was done during and after the first World War. In the period which followed we have experienced many resultant ills. The development of good irrigated land for food production in the war emergency instead of submarginal land certainly has some material advantages. Most of the crops grown on irrigated land are not crops in which great surpluses usually develop. When some nine million soldiers return from the service many will wish to turn to the land as soldiers have done since the time of the Roman wars. The chances of making a livelihood on an irrigated unit are somewhat brighter than on some of the dry-land, submarginal homesteads taken by the boys who returned from the Spanish-American War.

There is well-grounded fear that persons returning from defense industries may turn to the poor land which can be easily had at all times unless industry can absorb immediately this class of worker. If there be some irrigation projects developed but not yet settled at that time, our future problems of rehabilitation will be more easily solved and there will be less wasting of national resources by erosion if we direct settlement to them rather than to submarginal acres.

Development of Irrigation. The development of irrigation projects has changed considerably since the beginning of the early days in the West. It was thought at one time that, if water were delivered to the farm, the irrigator could clear the land of sagebrush, level it with a horse-drawn drag, and pay high operation and maintenance and construction charges to the irrigation district at the same time. He was expected to learn the complicated processes of irrigation farming, including water application and soil management, in his idle moments. Good engineering work was done on the larger dams and canals, but the farmer was left to work out his own salvation, and, as a result, many early irrigation districts and the settlers were doomed to bankruptcy.

The development of irrigated land at present includes land leveling operations and the layout of the ditch system and row direction as an important part of the farm engineering job. Land in its natural topography is seldom suited to the application of water. In the modern conception of project planning the present boundaries of farms, the roads, and minor civil subdivisions might have to be disregarded and rearranged for the best possible final results.

In conclusion, let me say that we as agricultural engineers would be shirking our duty should we not call attention to the various possibilities for food production which are at hand. In the prosecution of this phase of the war effort let it not be said that we arrived "with too little and too late."

A Farm Unit Drier for Combined Rice

By E. L. Barger, Kyle Engler, and A. H. Thompson
MEMBER A.S.A.E. MEMBER A.S.A.E. JUNIOR MEMBER A.S.A.E.

THE RICE crop in Arkansas amounting to about one quarter million acres annually is harvested almost entirely by the binder thresher method. This is true also in Louisiana and Texas and to a somewhat lesser extent in California. High moisture content of the rice grain at harvest time is the main factor restricting the use of the combine to harvest the crop. Delaying the harvest to permit the standing grain to dry in the field results in decreased quality due to sun checking. The mechanical problems of combining the crop with present-day combines are not particularly difficult. Many rice farmers own combines for harvesting soybeans, oats, and lespedeza, but a satisfactory farm unit drier is needed to permit harvesting the rice crop with the combine. The advantages to be gained by the use of a drier in conjunction with the combine in harvesting rice are: (1) Reduced labor requirement, (2) decreased harvesting costs, (3) increased quality of product, (4) permit drying other crops grown on the rice farm that are harvested with the combine and frequently need artificial drying, and (5) reduce machinery requirements on the rice farm by eliminating duplication of harvesting and threshing equipment.

Rice farmers are showing unusual interest at this time in farm driers and use of the combine because of the problems that a labor shortage would create in the production of this food crop.

The design, construction, testing, and demonstration of a farm unit rice drier were the objectives of a wartime project started in April 1942 by the Arkansas Agricultural Experiment Station. An experimental drier was completed early in September and used during the 1942 rice harvest on the Rice Branch Experiment Station at Stuttgart, Arkansas. It was used to dry soybeans following the rice harvest. About 1,000 bu of rice were harvested with three different combines in the vicinity of the experiment station, dried in the experimental drier, and marketed in the usual channels.

The purpose of this paper is to describe briefly the design of the experimental drier and to report the results of one season's use. The project is not considered finished.

Article prepared especially for AGRICULTURAL ENGINEERING. Research Paper No. 769, Journal Series, University of Arkansas. Published with the approval of the Director of the Arkansas Agricultural Experiment Station. Authors: (Barger) formerly professor of agricultural engineering, University of Arkansas, now of Iowa State College; (Engler) associate professor of agricultural engineering, and (Thompson) formerly assistant agricultural engineer, University of Arkansas.

Use was made of research by the U. S. Department of Agriculture and reported in USDA Circular 292, entitled "Artificial Drying of Rice on the Farm". Pertinent data from that report used in the design of the experimental drier included:

1. Maximum drying temperature for rice 120 F (degrees Fahrenheit)
2. Not more than 2 per cent of moisture removed in a 24-hr period
3. Air velocities through rice of 50 to 75 fpm or an air volume requirement of 50 to 75 cfm per sq ft of drier surface area
4. Time of retention of ½ to ¾ hr under above drying conditions.

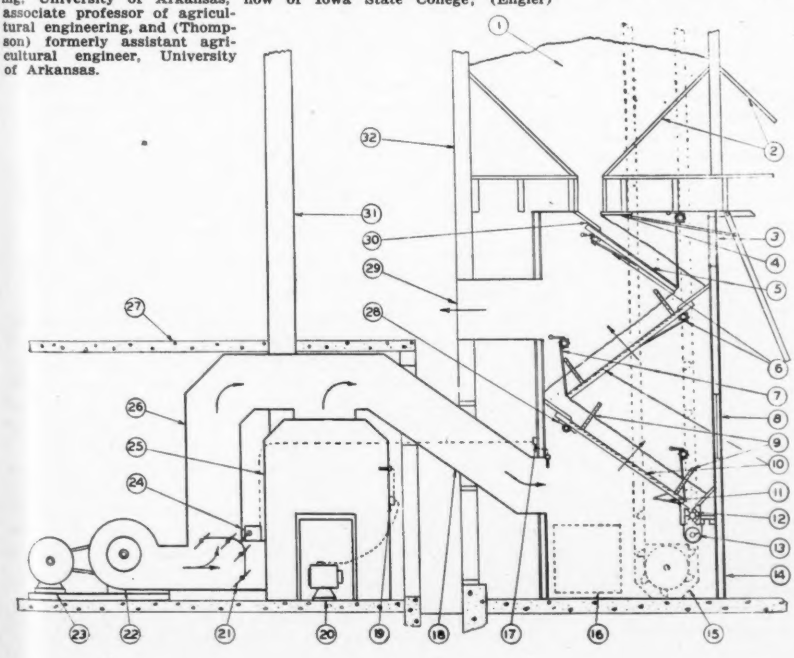
An attempt was made to design a drier that could be built at a minimum cost by incorporating stock equipment wherever possible and construction, a part of which could be done on the farm by local tradesmen. A capacity was desired that would handle one combine on the average rice farm. The experimental drier was intended to handle other crops grown on the rice farm including oats and soybeans and to fit into a conventional grain storage building with overhead bins.

A brief description of the experimental drier is given in the following paragraphs and in the accompanying diagram.

The drier column is of double-wall plywood (14) reinforced with two-by-twos glued and nailed. The four walls were made in separate sections and prefabricated. The experimental drier is 12 ft high to fit the rice storage building at the experiment station. Nine to ten feet of headroom would be sufficient.

Damp rice (1) from the combine is elevated to a hopper bottom bin (2) above the drier column and flows by gravity through an adjustable shutoff gate (4) and over a series of adjustable inclined trays. The top tray (5) serves only to regulate the depth of grain on the middle tray. The top tray may be modified or reduced in size to adapt the drier to buildings with less headroom. The perforated drying trays (10) were made up of non-adjustable thresher shoe sieve stock. The openings were modified slightly giving highly satisfactory flow characteristics. Depth of rice on the trays may be varied from about 4 to 10 in by telescoping sections (30) at the upper end of each tray. Depth adjustment is made on the outside of the drier by means of a cable and pipe windlass (6), the pipe acting also as a support and hinge point for the upper end of the tray.

A uniform depth of grain over the tray surface is maintained by adjusting the angle of the trays. Cable and wind-



A cross sectional diagram of the Arkansas rice drier. (1) Rice, (2) overhead bins, (3) inspection door, (4) shutoff gate, (5) solid bottom tray, (6) rice depth adjustment, (7) tray angle adjustment, (8) inspection window, (9) depth gauges, (10) perforated drying trays, (11) hinged hopper side, (12) fluted feed roll, (13) auger crossconveyor, (14) drying tower wall, (15) cup elevator, (16) inspection door, (17) damper motor thermostat and relay, (18) hot air duct, (19) burner thermostat and relay, (20) oil burner, (21) proportioning damper (22) blower, (23) electric motor, (24) damper motor, (25) hot air furnace, (26) bypass duct, (27) furnace house, (28) pipe hinge, (29) exhaust, (30) telescoping section, (31) stack, and (32) storage building wall

RICE DRYING AND MILLING QUALITY DATA

Lot No.	Harvesting and drying treatment	Variety	Moisture when combined, %	No. of times thru drier	Moisture after drying, %	Moisture removed, %	Wt. per bu, lb	Milling Data: Moisture, %	Hulled and broken, %	Results of Shelling: Thru 5½ sieve, %	Broken, %	Whole grains, %	Head Rice, lb	Total yield lb	Designation	Germination %
1	Air dried	Zenith	23.2				40.6	12.6	6.61	0.58	1.38	75.18	101.2	111.6	Prime	93
1	Art. dried	Zenith	23.2	4	14.9	8.3	45.4	14.4	6.85	1.15	2.84	71.79	97.2	110.2	Prime	87
2	Air dried	Zenith	26.5				37.0	11.6	3.01	0.43	0.83	75.35	101.9	111.6	Prime	83
2	Art. dried	Zenith	26.5	5	14.4	12.1	47.3	14.4	5.12	0.88	2.21	73.58	99.2	111.6	Prime	86
3	Air dried	Zenith	21.0				39.4	11.4	9.05	0.60	1.92	75.32	101.9	113.1	Prime	83
3	Art. dried	Zenith	21.0	3	14.4	6.6	46.4	14.6	12.16	0.86	2.56	73.86	99.9	111.6	Prime	84
3A*	Threshed	Zenith					42.4	10.5	5.69	1.01	3.47	73.77	99.9	113.1	Prime	95
3B†	Threshed	Zenith					44.8	11.4	10.49	1.20	4.22	74.21	99.9	116.0	Prime	96
4	Air dried	E. Prol.	27.0				40.4	13.5	6.10	0.27	1.01	78.50	105.9	116.0	Prime	89
4	Art. dried	E. Prol.	27.0	8	13.9	13.1	45.4	12.2	6.23	1.29	2.70	77.90	105.3	118.9	Prime	87
5&6	Air dried	E. Prol.	19.1				39.6	13.6	4.10	0.61	4.54	71.44	96.5	111.6	Prime	87
5	Art. dried unheated air	E. Prol.	19.1	4	14.2	4.9	44.2	13.6	4.43	1.03	3.75	71.42	96.5	110.2	Prime	92
6	Art. dried	E. Prol.	19.1	2	14.0	5.1	44.2	13.2	9.00	1.02	4.16	72.53	97.8	113.1	Prime	90

*Same field of rice as lot Nos. 2 and 3 except it was cut with binder and handled in the conventional manner.

†A field cut with binder about same time No. 1 was combined and handled in the conventional manner.

lass (7) adjustments with ratchets and pawls on the outside of the drier are used. The adjustment is made after the drier is started up since moisture content, condition of the grain, and variety influence the flow angle. Inversion of the grain mass as it moves from one tray to the next aids in obtaining uniform drying.

Retention in the drier is governed by the rate of discharge at the bottom. A fluted-roll type feed (12) is used. The feed shaft and an auger crossconveyor (13) are driven by a variable speed unit and electric motor. The crossconveyor discharges into a cup elevator boot (15) and the grain is elevated to overhead storage bins, or it may be returned to the drier hopper.

The furnace (25) is a domestic, oil-fired type with a capacity rating for household use of 275,000 Btu per hr. A blower (22) supplies drying air to the furnace at the cold air intake under a pressure of about one inch of water.

An automatic oil burner (20) of conventional design having a capacity of 1½ to 5 gal of fuel oil per hour was used. Oil was chosen for heat because it lends itself to automatic control. It is produced near the rice area and many rice farmers have facilities for storing oil for tractors and irrigation pumping plants.

A by-pass duct (26) was used that permits passing any proportion of the air through or around the furnace. Two methods of automatic control of drying air temperatures were provided. One consisted of hand setting the proportioning damper (21) to pass all, or any desired proportion of the air (usually about one-half), through the furnace and depend on a standard thermostat and burner control placed in the air stream at the drier to regulate the temperature. The second was obtained by operating the damper with a damper control motor (24) with a thermostat (17) located in the air stream at the drier and the burner thermostat and relay (19) located in the furnace jacket. The former method is simple and controls the air temperatures with a differential of about 4 deg (a plus and minus 2 deg) which appears to be satisfactory. The latter system is more accurate but the cost is greater and the need of closer control of air temperatures is questionable.

Both sheet metal and fireproof asbestos board were used in the duct work (18).

The controls in addition to the thermostats and relays for controlling temperatures by means of the damper control motor and the oil burner controls include a temperature limit control in the air duct between the furnace and drier which automatically shuts off the power if a temperature of 150 deg is reached. A furnace stack thermostat and relay causes a shut down of the burner before a dangerous temperature is reached in the stack. A current interruption or a failure of the fuel oil supply will automatically close down the drier.

After the drier is started and adjusted its operation is continuous and automatic. An operator is needed at infrequent intervals. During the day while the combine is operating the damp rice is put directly through the drier. After combining is stopped for the day a rerun of rice harvested the preceding two days is started. The 24-hr capacity of the drier must be about three times the daily capacity of the combine.

It is necessary that at least two storage or tempering bins in addition to the drier hopper bin be provided. Each of these bins should hold an amount equal to the daily capacity of the combine. There are rice varieties differing widely in maturing dates, therefore by proper selection of varieties it is possible to extend the harvesting period over several weeks. This makes possible the use of smaller combines and thereby lighten the load on the drier.

Drying and milling quality tests were made on six lots of rice. The results of milling quality tests are shown in the accompanying table. The two varieties represented, Zenith and Early Prolific, are both early maturing medium grain varieties.

The moisture content of the combined rice varied from 19.1 to 27.0 per cent with an average of 23.2 per cent. Check samples were taken as the rice was received from the combine, placed in small sacks and allowed to dry slowly in the driveway of the storage building. These are reported as "air dried". Two samples of rice handled in the conventional manner with the binder and thresher were obtained for milling quality tests. Lot number 5 was dried in the experimental drier with unheated air. The number of trips through the drier was varied from two to eight.

The greater weight per bushel of the combined and artificially dried rice is due partly to its greater moisture content when tested and partly due to the scouring action of handling making it less bulky. The average weight of the artificially dried rice was 45.7 lb per bu as compared to 39.4 lb for the check samples and 43.6 lb for the binder-thresher samples.

The "hulled and broken" column indicates the percentage of rough rice hulled and broken in the threshing process. The average value for all combined samples is 6.60 per cent while the two binder-thresher samples gave 5.69 and 10.49 per cent hulled and broken. Indications are that hulling is undesirable when the rice is dried artificially. Since the dehulled grains dry more rapidly they are more susceptible to checking. Also they may become discolored in the drying process. Careful adjustment of the combine to reduce hulling to a minimum is therefore desirable.

It was observed that most of the dehulled grains in the rice that had been artificially dried were checked and would be likely to break in the milling process. Results of shelling tests gave an average value of 1.04 per cent of the artificially dried samples through a 5½ sieve while the air-dried check samples average 0.44 per cent. The percentage of broken grain for the artificially dried samples and their companion air-dried samples are 2.89 and 1.93, respectively. These differences are reflected in the percentage of whole grains; being slightly lower for the artificially dried samples than the air-dried check samples but about on a par with the conventionally threshed samples.

The milling yield of head rice (pounds of whole grains per barrel of 162 lb of rough rice) averaged 100.3 lb for the artificially dried samples and 101.6 lb for the check samples. The same varieties handled in the conventional binder-thresher method averaged 99.9 lb of head rice. Total yield of milled rice per barrel of rough rice is high for all samples and shows no significant advantage for any method. The grade designation was prime for all samples.

Additional performance and milling data are needed to prove the practicability of the combine and the artificial drier. Also there are prejudices among farmers, buyers, and millers that can be overcome only by successful demonstration of the system or by the pressure of circumstances such as would result from a serious labor shortage.

AUTHOR'S ACKNOWLEDGMENT: Credit is given L. C. Carter, assistant director in charge of the Rice Branch Experiment Station, for assistance in operating the drier and furnishing the data on the milling quality.)

A Machine for Collecting Fallen Peppermint Leaves

By R. H. Wileman and N. K. Ellis

MEMBER A.S.A.E.

MENTHOL, formerly obtained from the Far East, now must be extracted from domestic peppermint oil, which is found in all the above-ground parts of the peppermint plant, though most of it is found in the leaves. Tests show that the highest yield of oil will result when the amount of total menthol in the oil approaches 50 per cent. At this stage, however, there is considerable loss of leaves from the plant.

Although other workers in the past have reported yields of oil from fallen leaves to be low, but with varying menthol and ester content, preliminary work in 1940 at the Purdue University Northern Indiana muck crops experimental farm gave encouraging yields of high menthol and ester content oil. Leaves were picked up by hand that year and distilled in an experimental still. The yield of oil was 1.25 per cent on the basis of field dry leaves. In addition, the percentage of total menthol, percentage of esters, and the degree of negative optical rotation, all exceeded that of the average regularly distilled oil.

Accordingly in 1941 a small experimental machine using the partial vacuum principle for picking up the fallen leaves was designed and constructed. This machine worked quite satisfactorily for test purposes and showed that the fallen mint leaves could be picked up by this method. The results of the 1941 studies are shown in Table 1.

Comparison of the chemical analyses of oil from the eleven lots of salvaged leaves with oil from regular cuttings from the same plots shows a higher percentage of total menthol, a much higher percentage of esters, and a higher negative optical rotation for the oil from the leaves. The average yield of oil from the collected leaves was 3.7 lb per acre during the 1941 studies. Since considerable muck was picked up with the leaves, the oil weight based on the weight of dry leaves could not be accurately calculated, but it was approximately one per cent.

On the basis of this preliminary work a machine of commercial size as shown in Fig. 1 was designed and constructed prior to the 1942 mint harvest. This machine has two gathering nozzles, extending to the rear, which are attached to fans driven by the power take-off of the propelling tractor. These nozzles are pulled over the surface of the ground and collect the fallen mint leaves by means of the partial vacuum created by the fans. A large hopper is provided for separating the leaves from the air stream created by the fans and it also serves as a storage for the collected leaves. The type of material collected is shown in Fig. 2 which is a view inside the collecting chamber.

A machine for this purpose has two major requirements, namely, (1) it must be capable of picking up the mint leaves and (2) provision has to be made for collecting these leaves and dissipating the large volume of air without an excessive loss of leaves. Since considerable muck is picked up with the leaves, especially under dry conditions, it is desirable to exhaust as much of the muck as possible with the air. It was found that most of the muck particles could be blown out with the air by using a leaf-collecting chamber of proper size and design and by regulating volume of air used.

Article prepared especially for AGRICULTURAL ENGINEERING. Journal Paper No. 101. Purdue University Agricultural Experiment Station. Contribution of the Departments of Agricultural Engineering and Horticulture.

Authors: Respectively, associate in agricultural engineering and assistant in horticulture, Purdue University Agricultural Experiment Station.

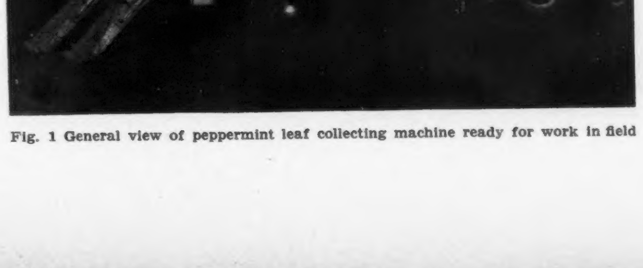


Fig. 1 General view of peppermint leaf collecting machine ready for work in field

The base of this machine consists of a trailer, with a bed 6½ ft wide and 12½ ft long. The hopper or bin for separating the leaves from the air and for collecting the leaves was provided by constructing sides and a front 7 ft high of ⅜-in plywood. An adjustable baffle to aid in separating the leaves from the air blast is provided over the top of the front 6 ft of the bin. This baffle is hinged at the front and can be raised or lowered depending on working conditions. The rear half of the top is uncovered and the bottom 18 in and the upper 3 ft of the back are open. A door 4 ft wide and 7 ft high is located in the center of either side of the leaf-collecting chamber. These doors are hinged at the bottom so that they let down and form a platform between the machine and the distilling tub for unloading.

TABLE 1. A COMPARISON OF THE YIELD OF PEPPERMINT OIL AND THE CHEMICAL AND PHYSICAL CONSTANTS OF THE OIL FROM THE REGULAR MINT CROP AND FROM THE LEAVES COLLECTED FROM THE GROUND BY PARTIAL VACUUM DURING THE 1941 SEASON

			Analysis		
Sample No.	Source	Yield of oil, lb acre	Total menthol, per cent	Esters, per cent	Optical rotation deg
5	Sample M, regular mint		60.39	10.48	– 29.3
6	Sample M. leaves		65.46	23.13	– 37.4
2	July 30 cutting, meadow mint	56.1	48.32	5.17	– 26.5
9	July 30 cutting, meadow leaves	4.00	49.07	5.66	- 26.8
3	August 4 cutting, meadow mint	59.5	46.20	5.00	– 26.5
12	August 4 cutting, meadow leaves		64.67	18.52	– 34.7
8	August 12 cutting, row mint	52.6	42.76	5.22	– 22.3
10	August 12 cutting, row leaves		60.90	18.50	– 30.8
20, 21, 23, 25,	Plots 37, 38, 39, 40.	66.72	51.28	5.56	– 24.5
26	Leaves from plots 37 to 40	3.30	66.23	14.45	- 33.6
36-39	Plots 1, 2, 3, 4.	60.6	54.29	6.06	– 24.4
48	Leaves from plots 1 to 4	3.8	64.20	14.42	- 32.0
40-43	Plots 5, 6, 7, 8.	56.1	56.82	6.50	– 25.8
49	Leaves from plots 5 to 8.	3.7	66.09	16.34	– 33.5
44-47	Plots 9, 10, 11, 12.	56.2	56.67	6.37	– 25.5
50	Leaves from plots 9 to 12.	3.1	63.72	13.96	– 31.7
51	Composite of oil from plants	38.7	59.78	6.97	– 21.0
52	Leaves from plants	2.7	67.71	16.68	– 30.05
53-55	Plots 71, 72, 73.	54.4	66.54	9.44	– 24.5
56	Leaves from plots 71, 72, 73.	3.86	73.13	20.35	– 35.0
57	Sample W, regular mint	72.00	49.28	5.08	– 22.9
58	Sample W, leaves	5.33	66.18	15.14	– 34.1

Two 18-in Axiflow fans are mounted on the rear of the trailer with the intake side toward the back and spaced 4½ ft between centers. To each fan is attached a gathering nozzle 4½ ft wide where it contacts the ground and with an opening which can be adjusted from 1 to 3 in in width. The two nozzles placed side by side give a coverage of 9 ft each time across the field (Fig. 3). The nozzles are designed and mounted so that when operating the backs of the nozzles, between the fans and the ground, form a 45-deg angle with the ground. They are attached to the fan thimbles by means of a flexible connection and supported by hinged arms which allow them to float when operating and thus follow the contour of the ground irrespective of the action of the trailer (Fig. 4). The rear of the nozzles are supported on runners which are adjustable so that the height of the nozzle openings with respect to the ground can be regulated to



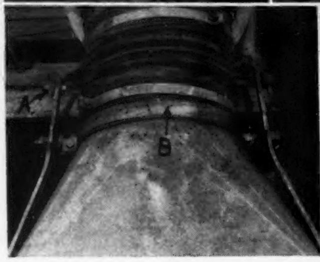
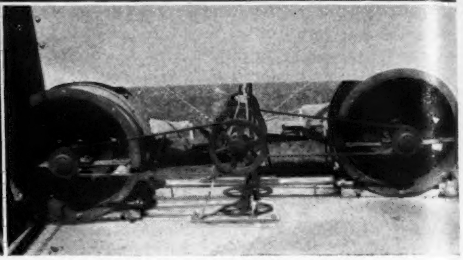



Fig. 2 (Upper left) Inside the leaf-collecting chamber showing type and condition of the material gathered • Fig. 3 (Upper right) Close-up of leaf-gathering nozzles. Each nozzle is 4½ ft wide • Fig. 4 (Lower left) Detail view of nozzle connection. The nozzles hinge at A and can turn sidewise in collar B so they can conform to the contour of the ground • Fig. 5 (Lower right) The fans and fan drives as seen from inside the leaf-collecting chamber

meet field conditions. The nozzles can be raised up and held off the ground by means of a windlass when not working in the field.

Power for operating the fans is supplied by a shaft supported to the underside of the trailer bed and attached to the tractor power take-off. The power is transmitted by means of V belts from the main shaft to a jackshaft mounted between the fans as shown in Fig. 5 which in turn drives the fans through V belts. Variable-pitch pulleys are used on the fans so that their speed can be changed to secure the air volume and vacuum desired.

Experience during the 1942 season indicates that an air velocity of about 2300 fpm at the mouth of the nozzles gives the best results under most conditions. This velocity of air results in a vacuum of 2 in water gauge in the throat of the nozzles and 0.95 in at the front of the nozzle apron. To secure these conditions the fans operate at a speed of 2530 rpm and each fan delivers air at 3700 cfm.

Due to difficulty in getting the fans the machine was not completed until most of the meadow mint was harvested. However, the areas of meadow mint from which leaves were collected were representative of much of the mint in northern Indiana. Leaves were collected at the Purdue experimental farm and on the farms of several commercial growers. Under most conditions the machine was operated at approximately 3½ mph, or with the tractor in second gear. When unfavorable conditions were encountered, the speed was reduced to 2¼ mph with the tractor in low gear. These speeds gave a coverage of 3½ and 2⅓ acres per hour of actual operation.

It is generally considered that there is a greater fall of leaves from meadow mint, which is two or more years old, than from row mint which is the planting for the first crop. This would mean that the collection of leaves from the meadow mint earlier in the season would be at least as profitable as from the later row mint crop. The results of the tests made during the 1942 harvest are shown in Table 2.

The average yield of oil from the regular crop for all areas given in Table 2 was 34.95 lb per acre, while the average yield of leaf oil was 4.36 lb per acre. This recovery is 12.63 per cent of the average yield of the regular crop, and at the present price of mint oil would have a gross value of $21.80 per acre.

It has been found from experience that the sooner the leaves are picked up after the hay is hauled from the field, the better the yield and quality of the oil. Oil from fresh leaves is clear and has a sharp although not unpleasant odor, similar to any regular run oil of high menthol content. Leaf oils exhibit a high negative optical rotation, often higher than the limit of −33 deg prescribed by the U. S. Pharmocoepia. The per cent of esters is always high and the per cent of total menthol exceeds the menthol content of oil from the regular crop.

There are two limitations which have been encountered in the use of the machine in the field. When much machinery is operated over dry muck soil, many of the leaves are pulverized and mixed with the soil. This is especially true in the case of row mint where large pick-up loaders are used. In cases where heavy rains fall after the hay is raked, the leaves are matted to the soil so that they are much more difficult to pick up than under normal conditions resulting in a rather poor job of collecting. However, since these conditions are the exception rather than the rule, the use of a machine of this type for collecting the fallen mint leaves, normally left in the field, should prove very profitable to peppermint growers and help materially in solving the menthol shortage.

TABLE 2. THE YIELDS OF MINT OIL FROM THE REGULAR MINT CROP AND FROM THE LEAVES COLLECTED FROM THE SAME AREAS TOGETHER WITH THE ANALYSES OF THE OILS SECURED DURING THE 1942 STUDIES ARE SHOWN IN THIS TABLE

Sample No.	Source	Yield of oil, lb acre	Analysis: Total menthol, per cent	Analysis: Esters, per cent	Analysis: Optical rotation deg
32	Area G, regular crop	50.00	53.57	5.49	– 24.6
31	Area G-1, leaves	3.35	60.28	13.04	– 30.3
26	Area G-2, leaves	3.75	60.20	14.07	– 30.8
29	Area G-3, leaves	3.90	60.99	14.30	– 31.4
23	Area G-6, leaves	4.00	61.50	14.43	– 31.4
34	*Area R-1-2, regular crop	45.00	50.99	5.53	– 26.4
36	Area R-1, leaves	7.00	58.32	9.87	– 31.1
35	Area R-2, leaves	5.66	65.63	14.31	– 34.5
38	Area L, regular crop	30.00	60.62	8.59	– 31.8
37	Area L, leaves	2.87	68.33	16.62	– 36.8
40	Spacing Plot-5, regular crop	54.50	52.18	5.75	– 26.9
39	Spacing Plot-5, leaves	3.60	61.78	16.23	– 34.8
41	*Section 4, meadow mint	24.50	63.32	8.25	– 32.3
42	Section 4, leaves	5.80	67.00	16.84	– 38.0
44	Plot-16, regular crop	43.00	61.27	10.84	– 30.6
43	Plots-13-16, leaves	1.88	62.69	20.58	– 34.7
47	Plot-25, regular crop	37.80	61.36	8.75	– 30.3
46	Plot-25, leaves	8.40	66.65	16.85	– 37.4
57	Area W, regular crop	34.50	55.27	7.93	– 25.5
53	Area W, leaves	1.50	63.18	16.00	– 31.3
49	Area WD, regular crop	36.40	52.13	7.29	– 28.8
58	Area WD, leaves	1.70	68.80	20.28	– 35.8
66	*Plot G 3 yr old, regular crop	12.70	59.50	12.40	– 32.0
65	Plot G 3 yr old, leaves	9.18	67.44	22.60	– 37.2
20	Second cutting, regular crop	16.10	51.11	6.05	– 17.5
16	Second cutting, leaves	3.00	68.09	19.71	– 30.6

*These areas were meadow mint; all others row mint.

A State-Wide Electric Brooder Program

By M. M. Johns

MEMBER A.S.A.E.

THIS paper deals strictly with the technique of organizing a state-wide homemade electric brooder program in Tennessee, which was initially organized in October, 1941, for the brooding season of 1942, and which was continued during the winter and spring months of 1943.

The Tennessee egg production goal for 1942 was set at 77,311,000 dozen, a 13 per cent increase over 1941, and this goal was reached. The production goal for 1943 was set at 88,000,000 dozen, a 15 per cent increase over 1942, and this goal will be reached if a feed shortage does not occur this year forcing farmers to sell their flocks.

At the very outset of this large increase in poultry production, our state extension poultry specialist stated that during wartime we should strive to have every farm raise at least 100 to 200 chicks, instead of having a few individuals go into the poultry production business on a large scale. Also the state extension agricultural engineers suggested that since 53,000 farms in Tennessee were receiving electric service and due to numerous new camps and war plants being constructed in the state, causing farm labor to become scarce, possibly electric brooding might play an important role in reaching the poultry production goals.

A conference was called in November, 1941, with representatives from the Tennessee Valley Authority, electric power companies, electric membership cooperatives, and municipal electric systems, together with the extension poultry specialist and the extension agricultural engineers, to discuss the possibility of a state-wide electric brooder program that would relate directly to the over-all poultry production program.

Inasmuch as we could not find a manufacturer that would promise delivery on brooders having a capacity of 200 chicks and less, due mainly to limitation orders that had been issued by the War Production Board, the extension agricultural engineer explained this situation to those concerned with the organization of the program and presented plans for homemade electric brooders. Our first plan showed the construction of a 30x30-in brooder having a capacity of 50 to 100 chicks; the second plan showed a 48x48-in brooder having a capacity of 150 to 200 chicks. The two plans were presented thinking perhaps we could standardize on the most popular size. However, the group agreed that we should have both plans if heating assemblies could be secured, which would include the electric heating unit, pilot light, attraction light, thermostat, thermometer, and curtain. Only one manufacturer said he could supply the complete heating assembly to meet our specifications and we accepted his offer.

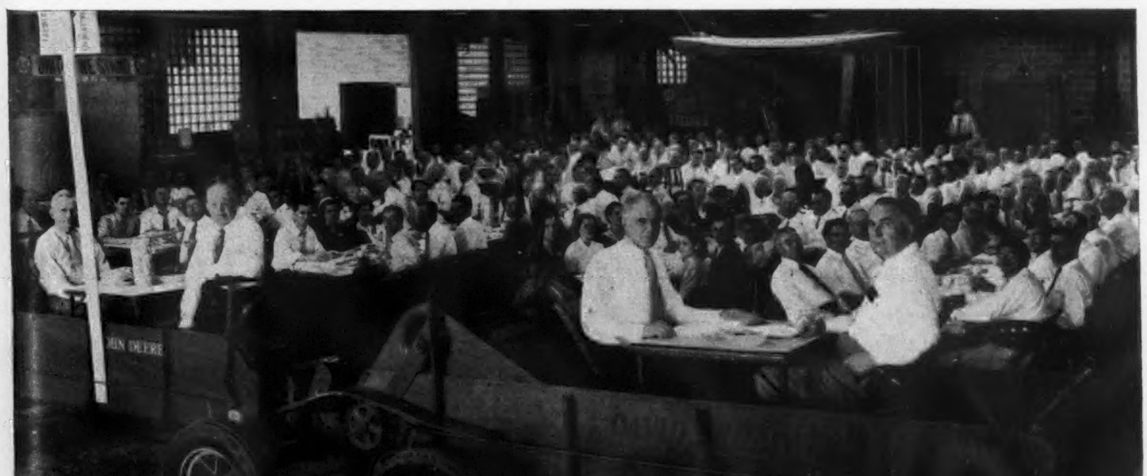
Our next problem was to locate dealers at various points throughout the state to handle these heating assemblies since the company furnishing them did not have active dealers established. After visiting ten large hardware and implement dealers, four hatcheries, and three feed companies, with very unfavorable reactions, we decided to waste no more time in locating dealers, since it was then the middle of December, 1941, and the brooding season was only a month off, but instead contacted the power companies, electric cooperatives, and municipalities relative to their ordering and stocking the heating assemblies.

From December 15 to January 1, 1942, the extension agricultural engineers visited the cooperating electric power distributors and county agents discussing the homemade brooder program. Many of the power distributors hesitated in stocking the electric heating assemblies since none of them were in the merchandizing business, but after explaining to them the need for increased poultry production and the difficulties we encountered in establishing dealers, they were much more favorable to our suggestion that they stock this equipment. They did, however, agree to order a demonstration unit for each county extension office in their service area.

We were successful in getting the manufacturer of the heating assemblies to establish a uniform net and list price to the companies and associations, f.o.b. factory. This enabled us to standardize on the price for the heating assemblies throughout the entire state and also enabled the purchasers to have the assemblies shipped as they desired. *(Continued on page 246)*

Paper presented at the annual meeting of the American Society of Agricultural Engineers at Purdue University, June, 1943. A contribution of the Rural Electric Division.

M. M. JOHNS is extension agricultural engineer, University of Tennessee.



This picture taken during the recent annual meeting of the American Society of Agricultural Engineers at Purdue University, shows the group of Society members and friends about to partake of the piscatorial feast in the agricultural engineering laboratory. (Occupancy of the equipment in the foreground does not necessarily constitute endorsement thereof by the occupants.)

The 1943 A.S.A.E. Gold Medalists

WILLIAM BOSS

The American Society of Agricultural Engineers awarded the John Deere Medal to William Boss and the Cyrus Hall McCormick Medal to Bert R. Benjamin on the occasion of its annual dinner, June 21, held during the 36th annual meeting of the Society at Lafayette, Indiana

BERT R. BENJAMIN

ON A farm near Zumbro Falls, Minnesota, a son was born to Andrew and Janet (Nisbet) Boss on October 7, 1869. His Scotch parents named him William. The farm was his home until he was 18. In 1895 he married Edna Florence Rider, and they had two sons. Member of many scientific, social, civic, and fraternal bodies, he probably would mention first his place in the Central Presbyterian Church of St. Paul.

William Boss had no formal education in agricultural engineering, yet he was one of the founders of the profession, a pioneer among creators of curricula for its teaching, designer of the first major building for its housing; without pattern or precedent in 1909, it still ranks as one of the best in its functional design.

After working as a carpenter in the community, he entered the school of agriculture of the University of Minnesota as a student; also as a stoker of a boiler and sweeper of a shop. Presently he appears as in charge of heating plants, water system, power plant; teacher of steam engineering; chief engineer, head carpenter, and instructor in carpentry and power machinery.

In 1905 he became half-time professor and chief of the division of farm structures and farm mechanics, forerunner of agricultural engineering. In his other half-time he was head of The Specialty Mfg. Co., of St. Paul, which he had organized in 1902. Among his 17 patented inventions and other developments as a manufacturer are the centgener machine whereby researchers are able to plant a definite number of seeds evenly distributed over a predetermined length of row; a plot thresher for determining experimental yields; a germinating chamber for controlling temperature and humidity, largely used by experiment stations and seed growers; and others not so closely related to agriculture. His family still owns the business.

In 1909 Mr. Boss left the University to concentrate on the business, but in 1918 he returned half-time, and within a year full-time, to head the growing and increasingly important work in agricultural engineering at the University, all at the pressing request of its authorities. Thenceforth, until his attainment of official retirement age in 1938, he directed an era of notable progress by the profession at Minnesota. Tangible landmarks of his administration include: organization of the agricultural engineering division; a definite program of official research by the experiment station in the realm of agricultural engineering; initiation in 1925 of a professional course in agricultural engineering; encouragement among his staff of contribution to agricultural engineering literature.

Professor Boss' own writings are too numerous to mention, or even to outline. Among them are an instruction book for threshermen published in 1906, a paper at the first meeting of the American Society of Agricultural Engineers and published in the first number of its Transactions, and *(Continued on page 247)*

NATIVE of Newton, Iowa, Bert R. Benjamin was born December 17, 1870, son of Jonathan E. and Louise M. (Boydston) Benjamin. After training in the grade schools and academy at Newton, he was graduated in 1893 from Iowa State College as a bachelor of science in mechanical engineering. Between terms at college he taught in the country schools of Jasper County, Iowa.

Henceforth his career was with a single company and its successor. Starting as a draftsman-designer of the McCormick Harvesting Machine Co., in 1893, he advanced steadily until his retirement from the International Harvester Co., in 1940, at which time he was engaged in agricultural practice research. Landmarks along the line were his designation in 1910 as superintendent of the McCormick Works experimental department, and in 1922 as assistant chief engineer in charge of Farmall development for the Harvester Company.

During his career Mr. Benjamin was granted 140 patents, equably divided among farm implements, tractors, and tractor attachments. It is said that at his retirement no other man active in the industry had so many patent numbers in use on machines in production. Notable among them were developments on the corn binder, knotter for the grain binder, corn shredder, and the cotton picker.

One of his major contributions to mechanized agriculture was development and application of the power take-off, primarily a means of transmitting power by shaft and universal joints directly from tractor engine to mechanism of drawn machine, useful also for driving mounted machines and auxiliary mechanisms. Liberated from the tractor limitations of bullwheel drive and from the power losses of its attendant gear train, machines such as the corn picker were made practical by the power take-off.

However, it was as "daddy of the Farmall tractor," a title bestowed on him by his associates, that Mr. Benjamin gave his greatest contribution to the tractor industry and worked the greatest change in American agriculture. It was by no means the first tractor designed for and successfully used in row-crop culture. But it did differ from prior designs in providing in one tractor a general design easy to control accurately in row-crop work, a full line of attachments or mounted implements for planting, cultivating, and other operations in row crops, and at the same time an adequate and convenient source of power for drawbar work.

Today, two decades after creation of the original Farmall, its basic design still stands as the pattern for the all-purpose tractors not only of his own company, but of every experienced and well-established builder of tractors. Pursuing the path he blazed from first principles then, an industry united in recognition of Mr. Benjamin's concepts, yet rivalling one another in their evermore efficient application, has brought the blessings of power farming to the growers of corn, cotton, potatoes, and a host of vegetable and small fruit crops. *(Continued on page 247)*

NEWS SECTION

North Atlantic Section Meeting

THE NORTH Atlantic Section of the American Society of Agricultural Engineers will hold its usual yearly meeting in New York City on September 27 and 28. Hotel headquarters have not been definitely announced, but the meeting will probably be held at the Belmont Plaza Hotel.

According to announcement by Section Chairman, Archie A. Stone, the program committee is at present arranging a program of particular interest to agricultural engineers in the North Atlantic States, and it is planned to make it in every sense a wartime conference. The program will be announced at an early date.

Personals of A.S.A.E. Members

H. W. Dearing, Jr., recently resigned as assistant extension agricultural engineer, Alabama Polytechnic Institute, to accept a position as agricultural engineer with the Tennessee Coal, Iron, and Railroad Co.

Mack M. Jones and *Lloyd E. Hightower*, agricultural engineers, University of Missouri, are authors of Bulletin 468, entitled "Farm Tractors — Their Care, Operation and Maintenance" just issued.

S. W. McBirney, associate agricultural engineer (BPISE, ARA), U. S. Department of Agriculture, is author of Farmers' Bulletin No. 1933, entitled "Sugar-Beet Blocking by Machinery," recently issued.

J. R. McCalmont, formerly assistant agricultural engineer, farm structures research division (BPISAE), U. S. Department of Agriculture, and now a lieutenant in the U. S. Naval Reserves, is author of USDA Farmers' Bulletin No. 1931, entitled "Care and Use of Rope on the Farm," recently issued.

E. M. Mervine, agricultural engineer (BPISAE), U. S. Department of Agriculture, is one of the authors of Bulletin No. 476, entitled "Mechanical Thinning of Sugar Beets", recently issued by the Colorado Agricultural Experiment Station, Fort Collins.

Harold T. Palmer is now connected with the industrial engineering department, Glenn L. Martin-Nebraska Co., of Omaha, Nebraska. More recently he was equipment and inventory inspector of the USDA Farm Security Administration.

Earle K. Rambo, extension agricultural engineer, University of Arkansas, is author of a publication, entitled "Homemade Potato Grader," just issued. It is designated Extension Plan Series No. 4.

On the left, in this picture, is Harry B. Walker, who retired as President of A.S.A.E. at the close of the Society's annual meeting at Lafayette, Ind., last month, and on the right is Arthur W. Turner, President for the year 1943-44. Center, the secretary-treasurer of the Society.

A.S.A.E. Meetings Calendar

September 27 and 28 — North Atlantic Section, New York City.

December 6 to 8—Fall meeting, La Salle Hotel, Chicago, Illinois.

Charles H. Reed has resigned as assistant extension agricultural engineer of Purdue University to accept appointment to a position in the research laboratory of the Douglas Fir Plywood Association.

Jefferson B. Rodgers is now chief engineer, War Hemp Industries, Inc., with headquarters at 208 South LaSalle St., Chicago.

Dwight D. Smith, project supervisor, Soil Conservation Experiment Station, U. S. Department of Agriculture, is author of Bulletin 469 of the Missouri Agricultural Experiment Station, entitled "Soybeans and Soil Conservation," just issued. The report, a joint study by the SCS and the Missouri Station.

J. C. Wooley, professor of agricultural engineering, University of Missouri, has developed a device for salvaging bale ties which is described in Circular 255 recently issued by that institution.

Forrest B. Wright, assistant professor of agricultural engineering, Cornell University, is author of Bulletin 541 (War Emergency Bulletin 49), entitled "Care of Electric Motors," issued recently by the Cornell Extension Service.

Necrology

Wyatt A. Clegg passed away recently at his home in Rome, Georgia.

Mr. Clegg was a native of Alabama, and a graduate of the University of Georgia, where he served as professor of agricultural engineering from 1920 to 1929. In the latter year he became associated with the Caterpillar Tractor Company as district agent, with whom he continued until his retirement three years ago.

W. A. Clegg was a veteran of World War I, having served as a petty officer first-class in the U. S. Navy.

Mr. Clegg became a member of the American Society of Agricultural Engineers in 1920 and was prominently identified with the activities of the Southern Section of that organization, and served a term as section chairman.

Mr. Clegg is survived by his wife, Nova Benford Clegg, one daughter, Gerrye Clegg, his mother, and six sisters.

Applicants for Membership

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

R. H. Danhaus, engineer, Electric Wheel Co., Quincy, Ill. (Mail) 2105 Washington St.

Matthew E. Hamilton, designer, J. I. Case Co., Racine, Wis. (Mail) 2046 Deane Blvd.

Lynn K. Huffman, farm equipment service supervisor, Montgomery Ward & Co. (Mail) 319 S. George St., Mt. Prospect, Ill.

Igor Kamlookhine, engineer, Allis-Chalmers Mfg. Co., Milwaukee 2, Wis. (Mail) 1609 N. Prospect Ave.

Gerald L. Kline, Officer Candidate School, U. S. Army. (Mail) Officer Candidate Class No. 72, Fort Sill, Okla.

Edward R. Murphy, assistant chief engineer, Gypsum Association, 211 W. Wacker Drive, Chicago, Ill.

E. Floyd Redding, district architect, Farm Security Administration. (Mail) 1048 Columbine St., Denver, Colo.

J. Arnold Roberts, provincial agricultural engineer, New Brunswick Department of Agriculture. (Mail) Fredericton, N. B., Canada.

A. R. Schwantes, agricultural engineer, Insulite Division, M. & O. Paper Co. (Mail) 1222 E. Como Blvd., St. Paul, Minn.

Dawson C. Womeldorff, agricultural engineer, Public Service Company of Northern Illinois. (Mail) Room 1211-c, 72 W. Adams St., Chicago, Ill.

Agricultural Engineering Digest

A review of current literature by R. W. TRULLINGER, assistant chief, Office of Experiment Stations, U. S. Department of Agriculture. Copies of publications reviewed may be procured only from the publishers at the addresses indicated.

HYDRAULICS OF SPRINKLING SYSTEMS FOR IRRIGATION, *J. E. Christiansen.* Amer. Soc. Civ. Engin. (New York) Proc., 67 (1941). In 1932 (about 2 years after portable systems for sprinkling agricultural crops were first used in California) the Division of Irrigation of the University of California began a study of sprinkling, principally to determine (1) the hydraulic characteristics of rotating sprinklers, (2) the loss of water by evaporation, (3) the hydraulic characteristics of sprinkler lines, (4) the cost of applying water by sprinkling, and (5) the general success of sprinkling as a method of irrigation. The present paper is concerned with the first three of these subjects.

From field observations and from an analysis here given, it is concluded that sprinklers must be placed closer together than is indicated by the study of symmetrical patterns. The usual spacings of 20, 30, and 40 ft along the line and from 50 to 70 ft between lines give fair results when there is adequate pressure and little wind. The customary spacings of from 60 to 90 ft both ways for stationary overhead orchard systems, however, cause an appreciable variation in application. For evaporation from the spray an expression was derived from the general evaporation formula by assuming that the insolation, the conduction, and the back radiation are negligible and can be omitted. The sensible heat is indicated by the change in the temperature of the water. Loss from this cause was found to be less than 1 per cent. Loss from the wet surface of soil and plants during and following the application of water probably exceeds that from a free water surface, however, because of the relatively larger area exposed, and, although the rate decreases rapidly as the surfaces dry and becomes negligible after about a week, during this time the total loss may have exceeded an inch of water. One of the practical results of the analysis of sprinkler line hydraulics is that of emphasizing the advantages of using two short lines supplied from a source through the center of the field instead of a single line of twice that length supplied from a source along one side of the field.

NEW ELECTRIC LAMP BROODER, *D. C. Kennard and V. D. Chamberlin.* Ohio Ag. Exp. Sta. (Wooster) Spec. Cir. 63 (1942). This brooder consists essentially of a 4x4-ft top and 1-ft sides made from a 4x8-ft piece of 1/4-in plywood or sheet of 1/8-in hard fiberboard, top and sides being nailed to 1x1-in cleats so that the sides project 4 in above the top to provide space for litter-insulation material, the whole being supported on four 16-in legs 1½x 1½-in and heated by one 150-w reflector type flood lamp and one 250-w drying lamp. It was found unnecessary to provide either thermostatic control or mechanical ventilation. Side curtains were used only when the behavior of the chicks indicated draft. When curtains were needed, strips cut from feed bags and made 4 ft by 8 in were satisfactory.

These brooders have proved effective in extensive use throughout the year under widely varying conditions.

FIREPLACES AND CHIMNEYS, *A. H. Senner and T. A. H. Miller.* U. S. Dept. Agr. (Washington) Farmers' Bul. 1889 (1941). This bulletin supersedes Farmers' Bulletin 1649 on the same subject. The present bulletin first takes up chimney design, construction, and cleaning and repairing flues in considerable detail. Fireplaces of both indoor and outdoor types are then discussed, the indoor constructions dealt with including such modified fireplaces as the Franklin stove and designs providing for circulation of air from the room through ducts heated by the fire, with return to the room through grilles or registers above the fireplace. Beauty and appropriateness of design are considered, as well as safety, effectiveness, and convenience.

CONSOLIDATION OF ELASTIC EARTH LAYERS, *D. L. Holl.* Iowa State Col. (Ames) Jour. Sci., 16 (1942). The author presents a mathematical analysis of saturated earth layers of finite and infinite depth. In the axially symmetric case several types of boundary conditions are considered.

AGRICULTURAL ENGINEERING INVESTIGATIONS BY THE GEORGIA STATION, Georgia Ag. Exp. Sta. (Athens) Rpt. 1941. Delinting of cottonseed on small experimental gins is noted.

AGRICULTURAL ENGINEERING INVESTIGATIONS BY THE BUREAU OF PLANT INDUSTRY. U. S. Dept. Agr. (Washington) Bur. Plant Indus. Rpt., 1941. A 50 per cent increase in the number of orange boxes per car having necessitated special fan equipment, car wheel-driven fans were placed in several hundred cars and were found more effective at normally low temperatures and during much of the season than was car icing alone.

WATER LEVELS AND ARTESIAN PRESSURE IN OBSERVATION WELLS IN THE UNITED STATES IN 1940 (Part 5, Northwestern States), *O. E. Meinzer, L. K. Wenzel, et al.* U. S. Geol. Survey (Washington), Water-supply Paper 910 (1941). Data similar to those appearing in the preceding numbers of this series are here brought together. Following a general summary by Meinzer and Wenzel of changes in ground-water level in 1940 in the northwestern part of the United States, reports for Idaho, by J. W. Robinson and G. C. Taylor, Jr.; for Montana (Flathead Valley between Flathead Lake and Kalispell), by R. C. Cady; for Oregon, by J. E. Upson; for Utah, by H. E. Thomas and W. K. Bach; for Washington, by Taylor and Robinson; and for Wyoming, by T. W. Robinson are presented.

PROPOSED RECOMMENDED PRACTICE FOR THE DESIGN OF CONCRETE MIXES, *R. F. Blanks et al.* Jour. Amer. Concrete Inst. (Detroit, Mich.) 13 (1942) No. 3. A general procedure is outlined, an illustrative computation is given, and discussions by T. C. Powers, G. H. Larson, and W. H. Price are appended.

AGRICULTURAL ENGINEERING WORK OF THE U.S.D.A. AND STATE EXPERIMENT STATIONS. (Partly coop. Md., Miss., S.C., Tenn., and N. J. Ag. Exp. Stas.) U. S. Dept. of Agr. (Washington) Sec. of Ag. Rpt., 1941. Work of various experiment stations here noted includes the design of a portable grain drier, development of a cement and cotton shingle, electrically heated sweet potato storages, and improvement in some elements of oil plant equipment. The work of the Rural Electrification Administration and its relation to national defense requirements is reported upon, as is also the work of the Bureau of Agricultural Chemistry and Engineering on farm machinery and on heating, storage and electrification.

CALIFORNIA EXPERIENCE WITH THE EXPANSION OF CONCRETE THROUGH REACTION BETWEEN CEMENT AND AGGREGATE, *T. E. Stanton, O. J. Porter, L. C. Meder, and A. Nicol.* Jour. Amer Concrete Inst. (Detroit, Mich.) 13 (1942). No. 3. Use of high-alkali cement in conjunction with certain California aggregates caused distress in the resulting concrete whereas low-alkali cement gave no such trouble, and non-reactive aggregates showed no such effect with the high-alkali cement. Opaline silica was found to be one of the reactive aggregate components.

OBSERVATIONS ON THE DURABILITY OF DRY TAMPED SILO STAVES, *C. A. Hughes and K. A. Anderson.* (Univ. of Minn.) Jour. Amer. Concrete Inst. (Detroit, Mich.) 13 (1942). No. 3. Cubes cut from dry-tamped silo staves were subjected to durability cycles consisting of frost action alone or a combination of frost and acid action. It is concluded that the transverse strength and absorption are not adequate criteria of the durability of dry-tamped silo staves. Frost action was found the chief factor in silo durability, though acid action remains important because of its accelerating effect on the rate of disintegration in freezing and thawing tests. A procedure for a durability acceptance test is proposed.

AGRICULTURAL ENGINEERING INVESTIGATIONS. N. Y. (Cornell) Ag. Exp. Sta. (Ithaca) Rpt. 1941. Field tests of the performance and control of tractor-mounted two-way plows on sidehills and other work on farm power machinery are reported upon by B. A. Jennings and F. W. Barrett; trials showing the superiority of the telephone type of petticoat insulator over three other types of insulating supports for electric fences are noted by H. W. Riley and R. O. Schlegelmilch; the development of a new type of electric incubator, by S. R. Crus; cooperative tests of fencing, by Riley and Jennings, in cooperation with the American Society for Testing Materials, the National Bureau of Standards, and manufacturers of wire fencing; and a pick-up baler and haymaker (crusher), by H. B. Hartwig. *(Continued on page 244)*

Agricultural Engineering Digest

(Continued from page 242)

Oklahoma Houses for Laying Hens, *R. B. Thompson.* Okl. Ag. Exp. Sta. (Stillwater), Bul. 253 (1942). Following a brief discussion of such general requirements as adequate ventilation, sunlight, suitability of size and location, etc., this bulletin presents bills of material, working drawings, and some notes on constructional detail for the building of a 20x20-ft even span, straw-loft house and of a shed-roof house. Suggestions for the improvement of unsatisfactory structures already in existence are also given.

Snow Increases the Moisture Content of Grain, *T. E. Long.* North Dakota Ag. Exp. Sta. (Fargo), Bimo. Bul. 4 (1942), No. 3. In 14 bins of 20-bu capacity in which the wheat content of seven was covered with building paper and that of the other seven left uncovered, there was an average increase of 1.7 per cent moisture content in the uncovered wheat from February 3 to March 3, 1939. During this same period the covered wheat showed an increase of only 0.3 per cent. The walls, bottoms, and roofs were all tight in these bins, and the only place that snow could enter was under the eaves of the roof. Sealing of all joints with a caulking preparation is a suggested remedy. Points of entrance especially mentioned are the rib of the roof, the door, and the top edge of the side wall. Any snow collecting on the building paper covering should be removed.

Agricultural Engineering Investigations. Missouri Ag. Exp. Sta. (Columbia) Bul. 438 (1941). These included studies of poultry housing; efficiency of tillage methods in growing corn, by M. M. Jones, R. P. Beasley, and L. Hightower; a portable sheep dipping tank, by J. C. Wooley and Jones; small combines, by Jones; and erosion control by thin section overfall structure and contour furrowing of permanent pastures, both by Wooley.

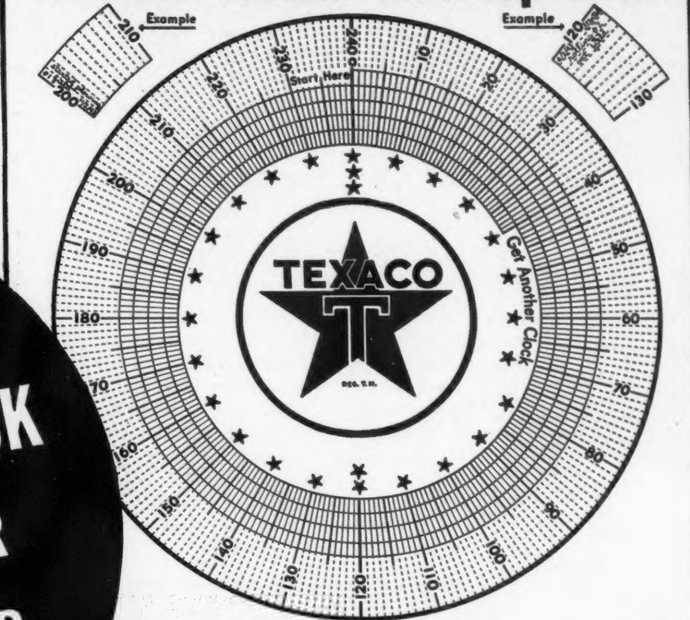
Classification of House and Barn Paints as Recommended by the U.S.D.A., *F. L. Browne.* (Coop. Univ. Wis.) U. S. Dept. Agr. (Washington), Tech. Bul. 804 (1942). This bulletin describes a system of classifying paints by groups, types, and grades, which is the result of many years of research by the USDA Forest Products Laboratory on the painting of wood. It is pointed out that adoption of this system by manufacturers will allow a decided simplification of the technical statements on paint-container labels, and will make it possible to tell paint users more clearly and effectively how to identify the many kinds of paints on the market, what the characteristics of each kind of paint are, and how each should be applied and maintained. The classification system places no limitations upon the formulas used by paint manufacturers, and leaves the manufacturer complete freedom to change and improve his formulas at any time.

Improved Bates Laboratory Aspirator, *E. N. Bates.* U. S. Dept. Agr. (Washington) Cir. 630 (1942). The aspirator described consists essentially of a receiving hopper, feed-control mechanism, aspirating chamber, hopper for receiving the discharged coarse, heavyweight material, connecting passage from aspirating chamber to cyclone, cyclone separator, flexible transparent cup for holding the lightweight material discharged from the cyclone separator, suction fan, motor, and motor control devices, a valve in the connecting passage for controlling the velocity of the air, and the mounting or support for the entire apparatus. The receiving hopper which holds the material to be aspirated has a volume of approximately 3 qt dry measure, equivalent to about 5 lb of wheat. A diagrammatic cross-section drawing indicates the relation and functions of parts and principle of operation. Applications of the device for the cleaning of rice and some other grains and seeds are discussed. This is a revision of an earlier design.

Cooling Eggs on the Farm and at Grading Stations (Progress report), *J. W. Weaver, Jr., R. L. Bryant, and C. Rogers.* (Coop. Va. Expt. Sta. et al.) U. S. Dept. Agr. (Washington), Bur. Agr. Chem. and Engin. (1941) ACE-104. Eggs held in experimental coolers prior to semiweekly shipment from the farm showed net increases in selling price of from 32 to 78c per case over similar eggs furnished not cooled. Precooling eggs for 45 min in a wire basket before storing them in cases in the coolers gave 2.3 per cent more extras than did no precooling. Loss in egg quality during shipment amounted to 80c per case for eggs held at room conditions and from 21 to 50c per case for eggs held in the coolers. Fresh laid eggs shipped in precooled cases from the coolers brought a net selling price of 20c per case more than those received for similar eggs shipped in cases not precooled. Cases containing flats and fillers will absorb 0.6 lb of water while in the coolers 7 days, and this water is later available to provide moist air around eggs en route to market. At a mean ambient temperature of 74 F the critical point of ambient relative humidity between high and low-quality eggs appeared to lie between 65 and 75 per cent. The construction and performance of two experimental coolers are briefly discussed.

NEW TRACTOR CHECK-UP CLOCK HELPS THE FARMER SAVE HIS TRACTOR

TEXACO Tractor Check-Up Clock



To Use The Clock, simply draw a pencil line or block in the space in the spiral beginning at the 0 mark, to the right, or clockwise, equivalent to the period of time each day that you use the tractor. For example, if you use the tractor 5 hours, the line would be drawn from zero to the midpoint between 0 and 10 on the clock, etc. Each successive period of use adds to this line. When the line reaches the point opposite the star, the check-up indicated below should be made. The spiral provides for a 1000-hour record of operation. In connection with this record, two suggested examples above the clock show how to use it.

★ **MAKE THIS CHECK-UP EVERY 10 HOURS**

PART	WHAT TO CHECK	WHAT TO DO
Air Cleaner	Dirt in cup	Clean and refill with fresh motor oil
Crank Case Breather	Dirt on filter	Clean, moisten filter mat with motor oil
Crank Case	Oil Level	Fill to proper level

CONSULT YOUR TEXACO TRACTOR LUBRICATION GUIDE FOR LUBRICATION CHANGE PERIODS

★ **MAKE THIS CHECK-UP EVERY 120 HOURS**

PART	WHAT TO CHECK	WHAT TO DO
Water Pump	For Leaks	Tighten or replace packing
Fan Belt	Tightness and condition	Tighten or replace
Brakes	Adjustment	Tighten or reline
Fuel Line	Sediment Bowl	Clean bowl and screen
Oil Consumption and Leaks	Quarts Used	If high, check seasonal grade of oil, bearings, pistons and rings
Oil Filter	Sludge	Clean or replace
Tires	Cuts, Wear, Pressure	Repair cuts, check alignment
Battery	Water	Fill to proper level with distilled water
Transmission	Level	Fill to proper level
Final Drive	Level	Fill to proper level

★ **MAKE THIS CHECK-UP EVERY 240-300 HOURS**

PART	WHAT TO CHECK	WHAT TO DO
Compression	Uniformity in all cylinders	If uneven or low, check valves, rings or cylinders
Spark Plugs	Condition and gap	Clean and set clearance
Radiator	Lime and air circulation	Flush system with soda and clean fins
Breaker Points	Condition and clearance	Smooth-up and set clearance
Ignition Cable	Condition	If rotted, replace
Front Wheel Bearings	Lubrication	Clean and repack with Texaco Marfak
Valve Tappets	Clearance	Adjust
Carburetor	Dirt in Fuel Strainer	Clean
Air Cleaner	Clogged Screen	Remove cleaner and wash out

CONSULT YOUR TEXACO TRACTOR LUBRICATION GUIDE FOR LUBRICATION CHANGE PERIODS
Keep a daily record of hours of tractor use. Don't guess at check-up intervals.

WIN THE WAR ON WEAR WITH TEXACO LUBRICANTS

THIS new Check-Up Clock developed by Texaco with the aid of leading Agricultural Engineers and practical farmers, tells what care to give tractors and when to give it.

It simplifies the farmer's problem of keeping track of tractor operation costs as well as fuel and oil consumption for rationing reports.

Tractor Check-Up Clocks will be mailed FREE to Agricultural Engineers. Just write to the nearest district office of The Texas Company listed below.

DISTRICT OFFICES

Atlanta, Ga.	Houston, Tex.
Boston, Mass.	Indianapolis, Ind.
Buffalo, N. Y.	Los Angeles, Calif.
Butte, Mont.	Minneapolis, Minn.
Chicago, Ill.	New Orleans, La.
Dallas, Tex.	New York, N. Y.
Denver, Colo.	Norfolk, Va.

Seattle, Wash.

Texaco Products also distributed by
McColl-Frontenac Oil Co., Ltd.
Montreal, Canada

WIN THE WAR ON WEAR WITH TEXACO PRODUCTS FOR THE FARM

A State-Wide Electric Brooder Program

(Continued from page 239)

On January 10, 1942, we began holding a series of construction conferences at each county agent's office. Those invited to attend this conference included the county agent, assistant county agent, home demonstration agent, vocational agricultural teacher, rural service engineer, or superintendent of cooperative, and the extension agricultural engineer. The power company or cooperative had agreed to purchase the complete bill of materials for the 50 to 100-chick size brooder and the heating assembly for each county in their service area. The construction material was purchased from a local lumber company at the county seat. This was done in order to determine the total construction cost including the heating assembly. The cost figures were later used in the county publicity program.

At the conference in each county agent's office, we constructed the homemade electric brooder to be used by the county and home demonstration agents for demonstration purpose at their community meetings in February and March covering poultry production.

Just imagine being on the second floor in the average county court house in Tennessee—nailing, sawing, hammering, and talking! By the time we had completed construction of the brooder, we had a large uninvited but curious crowd, which generally included the county judge, county court clerk, tax collector, health officer, county doctor, register, superintendent of schools, county treasurer, and sheriff and deputy. The county agent took advantage of this opportunity and called the county officials to order, at which time he explained the entire poultry program for the county, including the homemade electric brooder project. We were amazed at the success of the construction conference, in that never less than five heating assemblies were ordered by the county officials attending the uncalled meeting. In one county seventeen heating assemblies were ordered during the construction conference. Constructing the brooder in the county agent's office added much to the success of our homemade brooder program.

During February and March of 1942 and 1943, in cooperation with the county agent and the rural electric service representative or superintendent, we conducted what we called "homemade electric brooder clinics". The county agent and the rural service engineer or superintendent of the power distributor would send out joint letters to all farmers in the county having electric service, inclosing copy of Tennessee Leaflet No. 8, entitled "Homemade Electric Brooder", and return postcard. The state agricultural extension service printed 70,000 copies of Leaflet No. 8 in 1942 and 50,000 copies in 1943, and furnished sufficient copies, free of cost, to all power distributors cooperating in the program for mailing to their farm customers. Publicity regarding the electric brooder clinic was given ample space in the local county papers. The return postcard gave the power distributor an idea as to how much material would be required for each county clinic. In most instances the materials were cut to proper dimensions by the local lumber company.

Each person constructing a brooder or purchasing a heating assembly was given copies of extension literature on the following subjects: Electric brooders for raising chicks and poults, care and feeding of baby chicks, selecting the good layer, feeding laying hens, and control of poultry lice and mites.

Since most household electrical equipment had been sold, the brooder program easily acquired preference rating sufficient to occupy the window display space in most of the power company and cooperative offices.

Here is a tabulation of the results of the Tennessee homemade electric brooder program:

	1942	1943
Power distributors participating	16	33
Counties participating (95 in state)	43	72
50 to 100-chick size brooders constructed	800	1,000
150 to 200-chick size brooders constructed	450	1,400
Chicks raised as result of the program	200,000	748,000
Estimated dozens of eggs produced where homemade electric brooders were used	700,000	2,500,000

EDITORIAL

(Continued from page 222)

tion to the purchasing power of the dollars that the farmer has available, whether in the form of war bonds or otherwise. All are discounted in direct proportion to depletion of the dollar, and already it is being depleted at a rate several times as fast as the accrual of interest on government bonds.

Application of the excess profits principle to individual incomes would go far, we believe, to check this trend by reducing at the source the pressure on the volume and price of consumer goods. It would also help to mitigate some of the hardships among citizens who do not share in the immediate fruits of inflationary wages or profits. It should soften somewhat the shocks of postwar adjustments, both economically and psychologically.

William Boss

(Continued from page 240)

other major papers published from time to time in its Journal, Agricultural Engineering.

Twenty years after Mr. Boss became a charter member, by helping found the Society in 1907, he was elected its president. The next year he represented the Society in American Engineering Council and was on the administrative board.

For several years Professor Boss has been a registered professional engineer in the State of Minnesota. He is a member of the Society for the Promotion of Engineering Education and is a fellow in the American Association for the Advancement of Science. In human side of engineering. One of the important objectives in his life has been removing drudgery from human labor and making it possible to perform more and more tasks with improved tools and mechanical power, and to stimulate greater activity in the building of such farm structures as will add to the comfort and enjoyment of farm life.

Having reached the established retiring age at the University of Minnesota on June 30, 1938, he was retired as emeritus professor of agricultural engineering and at present is devoting his time to problems involving the betterment of living conditions for his fel-

Bert R. Benjamin

(Continued from page 240)

For some years, about nine of every ten tractors sold have been of the style set by Bert R. Benjamin. Its adaptability not only to row crops but to modest acreages has fortified the place of the family farm in America, has largely fulfilled the prayer of those who sought for small farmers an economic position befitting their social worth, and has fitted the gradual advance in eating habits and knowledge of nutrition.

New Literature

"The Tractor Field Book." Paper, 9x12 inches, 276 pages, illustrated. Farm Implement News Co., 431 South Dearborn St., Chicago.

This is the 1943 edition of this well-known compilation of facts and information of value to those who make, sell, or use equipment employed in mechanized farming. The book contains largely specifications and machine data on all makes of farm tractors, combines, corn pickers, corn shellers, internal-combustion-engine power units, hammer mills, husker-shredders, silo fillers, and threshers. It also includes a great deal of miscellaneous information covering Nebraska tractor tests (reports on all live models), a directory of tractor parts and service station equipment, etc.

"Introductory Shopwork," by Mack M. Jones, professor of agricultural engineering, University of Missouri, and Aaron Axelrod, instructor in machine shop science, Bayonne (N. J.) Vocational High School. Cloth, 6x9 inches, 290 pages, 366 figures. $2.50. McGraw-Hill Book Co., New York.

This book, prepared at the request of the War Department and the U. S. Office of Education in conformance with official preinduction training course outline No. CIT-103, explains the funda-

mentals of shopwork simply and clearly so that the reader without previous experience can more readily understand them.

It concentrates on tools, operations, processes, and materials, and so develops a working knowledge of principles which will apply to any jobs in the home or shop. The illustrations show graphically the uses of the tools and are valuable supplements to the book. Numerous self-questions are included at the end of each chapter. All the common essential hand tools are covered in detail as well as their proper maintenance and use in wood working, metal work, painting, wiring, and rope work.

Chapter headings are as follows: Hand Tools, Machine Tools, Common Essential Tools, Tool Sharpening, Grinding and Sharpening Equipment, Measuring and Gaging in Metalworking, Measuring and Marking for Woodwork, Sawing, Saw Sharpening, Planing and Smoothing, Wood Chisels and Their Use, Boring and Drilling Holes in Wood, Wood Fastenings, Use of Modeling or Forming Tools, Painting, Finishing and Glazing, General Bench and Vise Work, Metal Drilling Tools and Their Use, Bolts, Nuts and Threading Equipment, Pipework, Soldering and Sheet-metal Work, Wiring and Wire Splicing, and Ropework.

"The Refrigerating Data Book." Cloth, 6½x9½ inches, 510 pages plus supplement, illustrated. The American Society of Refrigerating Engineers, New York.

This is the fifth edition of a reference work sponsored by ASRE on refrigerating, heat and power engineering, air conditioning, domestic-commercial refrigeration, and refrigeration application. The book is a revision of the previous (1939) edition. It is entirely new in form and type face, and though much of the knowledge of refrigeration remains the same from year to year, the treatment in the new edition is largely new. The data book proper is divided into five parts under the following headings: Refrigerating Cycles, Fundamental Data, Industrial Systems, Domestic-Commercial Systems and Air Conditioning Systems. Supplementary material includes a catalog of leading manufacturers in the refrigeration and air-conditioning field, a directory of distributors, and a list of ASRE members.

EMPLOYMENT BULLETIN

The American Society of Agricultural Engineers conducts an employment service especially for the benefit of its members. Only Society members in good standing may insert notices under "Positions Wanted," or apply for positions under "Positions Open." Both non-members and members seeking to fill positions, for which ASAE members are qualified, are privileged to insert notices under "Positions Open," and to be referred to members listed under "Positions Wanted." Any notice in this bulletin will be inserted once and will thereafter be discontinued, unless additional insertions are requested. There is no charge for notices published in this bulletin. Requests for insertions should be addressed to ASAE, St. Joseph, Michigan.

POSITIONS OPEN

AGRICULTURAL ENGINEER to teach farm shop, farm engines, and soil erosion control, in a southern college. Salary up to $2700, depending upon qualifications. Persons interested may submit full particulars regarding training and experience to PO-142.

RESEARCH ENGINEER wanted for design and development of agricultural machinery and equipment for the Southeast. Salary up to $3,000, depending on qualifications. Persons interested are requested to write giving full particulars regarding training, experience, and other pertinent information. PO-141.

RESEARCH ENGINEER wanted to fill position at Virginia Agricultural Experiment Station, at salary up to $3200 to start. Agricultural engineer wanted to do research in rural electrification field. Present project includes egg cooling as a wartime activity in cooperation with U.S.D.A. Applicants should submit complete personnel record to Chas. E. Seitz, head, agricultural engineering department, Virginia Polytechnic Institute, Blacksburg, Va.

POSITIONS WANTED

AGRICULTURE ENGINEER, graduate in agriculture and mechanical engineering from Ohio State University. Major field of training in machinery and power, with broad experience in structures and conservation as well; considerable experience in planning, developing, and administrative activities; at present director of division of agriculture in private institution but desires change of location. Available August 15th, but preferably September 1st. PW-353

AGRICULTURAL ENGINEER (B.S., 1935) now employed in precision instrument factory as experimental engineer desires to change to agricultural engineering extension, research, or development work. Release from present position obtainable. Experienced in soil conservation, drainage, machine design and development, hydrology, flood control, vegetable and general farming, dairy and poultry farming, and the use, care and operation of farm machinery. Age 33. Married, with family. Draft status 3A. Interested only in permanent position. PW-352

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